MAY 1 5 1924

CHEMICAL & METALLURGICAL ENGINEERING

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DAILY EVENING — CIRCULATION DEPARTMENT — SUNDAY MORNING

ST. LOUIS POST-DISPATCH

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April 1, 1924

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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE
Editor

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Chilean Nitrate Producers Tighten Grip on Monopoly

NEWS of exceptional interest in the nitrate industry is reported elsewhere in this issue regarding recent action of the Chilean Nitrate Producers Association. This body, which controls 98 per cent of the production of Chilean nitrate, voted to continue its organization for the next 6 years, reduced the price of nitrate for the current year and passed a resolution not to sell nitrate to purchasers who may also buy from non-members of the association. About the same time the Chilean Government published a decree permitting the sale of nitrate lands only to members of the association during the life of that body.

The net effect of these activities is to circumscribe the business of non-members and to make purchasers dependent wholly on the Chilean monopoly. The downward trend of prices, though small, is an indication that Chilean producers recognize a similar trend in fertilizer nitrogen markets. This, of course, is welcome news to the fertilizer industry, but correspondingly unwelcome to producers of ammonium sulphate, to whom it means the necessity of reducing the price of their product. But the more serious aspect of the case as far as the United States is concerned is the prohibition of the sale of nitrate by any affiliated producer to anyone that will not do business exclusively with affiliated companies.

This decision to restrict sales of nitrate, if inclusive, means that American producers and dealers are either blacklisted by the organized producers or limited in their activities by the American law which restrains them from entering price-fixing organizations. It is a clear declaration of war against American interests in the nitrate business. The means to meet this hostile act are not obvious nor will the contest be short or easy. The ultimate result, however, is already clear. The United States will take steps to insure at the earliest possible moment full independence in nitrogen supply. It is intolerable that an act of this sort should permanently place a limitation upon the industrial and fertilizer use of nitrates.

Chemical Industry and The Flexible Tariff

ON June 4, 1924, in accordance with the proclamation of the President of the United States, the import duty on sodium nitrite will be increased from 3 cents to 4½ cents per pound. To industry in general this announcement is of little significance, for although sodium nitrite may be essential to dye and textile manufacturing, it is relatively unimportant from a tonnage or value standpoint. To the chemical industry, however, the change in duty on sodium nitrite marks a milestone in tariff history. It is the first chemical to be affected by the so-called flexible provisions of the tariff law of Sept. 21, 1922. Further significance arises from the fact that sodium nitrite has long been a storm center of tariff agitation and only last December was made the subject of test by the courts of the Tariff Commission's methods of investigation and report.

The 20 months that have elapsed since section 315 became a part of the tariff law have demonstrated, among other things, that the popular conception of flexibility as applied to tariff provisions is subject to considerable revision. The Tariff Commission, with the approval of the Executive, chose for itself a most conservative course in carrying out this particular provision of the tariff act. Its two recommendations to the President—on wheat and on sodium nitrite—have followed repeated hearings confirmed by field investigations of costs, production methods and other conditions of competition. In the case of sodium nitrite, cost figures were obtained for the three processes used by the domestic producers. An investigation was made in Norway, and although the foreign manufacturer did not permit access to his records of actual costs, nevertheless valuable information in regard to the competitive strength of the industry was obtained. A public hearing was held in September, a summary of the commission's information (except for confidential data) was compiled and submitted to the interested parties, and on Oct. 6 a final hearing was arranged for argument and filing of briefs. On the basis of this exhaustive study the commission made its recommendation that the duty on sodium nitrite should be increased by the full maximum of 50 per cent.

The interval between investigation and report was widened in this instance by the filing of a suit before the Supreme Court of the District of Columbia in which the representative of the Norwegian nitrite producer contested the Tariff Commission's right to withhold from publication the actual cost figures and other confidential information supplied by the domestic industry. The commission's stand in the matter was in keeping with its established policy, which in turn was based on a law prohibiting the disclosure of "trade secrets or processes" and imposing a severe penalty for such disclosures by any member of the commission's staff. The court upheld the government's contention that costs of production and similar confidential information are properly regarded as trade secrets. Thus the decision was as much a victory for domestic industry as for the Tariff Commission, since it stamped with legal approval the confidential relations existing between the two agencies.

This favorable decision, followed by the President's prompt action on the commission's recommendation, would seem to indicate that the way has now been cleared for further tariff adjustments. A dozen or more chemical products have been investigated and are awaiting decision at the hands of the commission. In the case of some of these, tariff adjustment is of urgent necessity, in others the element of uncertainty is having a discouraging effect on business. If the final stages of the investigational process can now be expedited without doing injustice to other petitioners, the chemical industry will be greatly benefited.

Helium, the Powerful Explosive

GRADUALLY the great war secrets are being revealed, and it seems that the longer we wait the more startling are the revelations. The latest is the secret of the Big Bertha, the powerful long-range gun of the Germans. The announcement comes not from the distinguished Professor Doktor Geheimrat Oberregierungsrat Dr. Ing. Schutzman of Burscheid bei Düsseldorf am Rhein, but from a comparatively unknown scientist—one Prof. A. Bettes, a former Spokane chemist and construction engineer now residing in Harrison, Idaho. But merely because the professor is hidden away in a Western hamlet, his scientific discoveries are not to go unheralded. Beneath a three-column head in the Spokane *Daily Chronicle* for April 28, 1924, his secrets are at last given to the world. From this report we learn that the powerful explosive used for the first time by the Germans was "none other than helium bound down and condensed to an explosive chemical."

Professor Bettes has carried the secret with him because his partner, the co-discoverer of the "tying-down" process, proved to be a traitor who sold the discovery to the German Government. When we entered the war the professor's patriotism prompted him to communicate with Senator William E. Borah of Idaho and to give him "the name of the only element that would combat the long-range guns of Germany." But instead of calling for Professor Bettes' aid our government wasted millions on expensive helium experiments and "failed to discover how to tie it down."

Those of our readers learning for the first time of the terrific explosive forces of helium will doubtless appreciate the story—or a part of it at least—in Professor Bettes' own words:

> Nitrogen is the chemical element with which all our wars have been fought. Nitrogen as a gas is not explosive. When the gas is condensed and bound down with carbon as in gunpowder or with silica as in dynamite, it becomes explosive.
>
> The density and energy of any element are inversely the one to the other. Nitrogen has a density of 14 as compared with hydrogen equaling 1. Helium is a chemical element having a density of 2. It has seven times the explosive force of nitrogen. If nitrogen will throw a shell 11 miles when exploded, then helium under similar conditions will have the power to throw it seven times 11, or 77 miles. The Germans succeeded in getting a projectile force of 76 miles out of helium.

Using the same line of reasoning, the uninitiated would guess that hydrogen would be twice as good as helium and have fourteen times the explosive power of nitrogen. Doubtless, however, Professor Bettes has found hydrogen difficult to tie down, perhaps because of its greater lifting power or the smooth corners on its atomic structure. In any event it took helium to do the trick and the Germans were under a very serious handicap because they were compelled to obtain their helium from the air. The Allies can be thankful, therefore, that there is only 0.000056 per cent by weight of this gas in the atmosphere, for, as Professor Bettes soliloquizes: "Had Germany had access to the quantities now found in Texas it is a question whether the result of the war would not have been reversed."

Almost as startling to the scientific world as is this exposé of Germany's great war secret is Professor Bettes' announcement that his discovery was made by the use of "an entirely different chemical theory than the atomic theory accepted by chemists the world over since the earliest ages."

The chemical law under which I work is simple and sure and explains in detail true chemical interaction. The adopted theory of a chemical interaction is that it is the result of a rearrangement of atoms within a molecular space. Such a theory will not stand the test of chemical analysis. The true chemical laws shows that chemical interaction is due to an inverse change in the density and the energy of the element—that is, as the density of the element is increased the energy is inversely decreased.

It is by this method that the power of helium was discovered by myself and my partner.

The obliging article in the *Chronicle* tells us that Professor Bettes is the possessor of numerous degrees from the largest universities in the United States and has followed chemistry for many years. "At present he has his laboratories and workshops on his ranch near Harrison, Idaho, where he is devoting the remainder of his life to developing his chemistry theories to a working basis."

This information we are glad to reproduce, for it should prove particularly useful to those dignitaries of our great scientific societies who at the moment are carefully weighing the competing qualifications of future recipients of the famous Gherkin and Pickles medals.

Code of Ethics For American Business

THERE is a familiar ring to the words attributed to a visitor to our shores, who in a recent interview stated that an empire of American finance over the whole earth, illiberal and cruel to the highest degree, is the nightmare prospect of the world. With the exception of the new phraseology, this statement is in close conformity with the oft-repeated imputation that Americans are lacking in business ideals. Almost coincident with this comes the announcement that the Chamber of Commerce of the United States through its committee on business ethics has formulated a code for the conduct of business, based on fifteen fundamental ethical principles.

The first principle—and it is typical of the others—reads as follows: "The foundation of business is confidence, which springs from integrity, fair dealing, efficient service and mutual benefit." The committee which prepared this report on business ethics comprised men of wide and diversified experience. The principles which they expound undoubtedly are based on personal connection with large industrial activities and are merely the reduction to concrete terms of the policies that have made possible the success and permanence of these industries. Thus the report, in itself, is a testament of the high ideals and ethical standards on which American business is founded.

The report, however, does more than codify standards. It personifies business in the abstract and attributes to it the function of providing for the material needs of mankind and of increasing the wealth of the world and the value and happiness of life. It places upon business the obligation of the equitable consideration due to capital, management, employees and the public. It affirms that business, when successfully and conscientiously carried on, renders a public service of the highest value. In short, this committee of business men has evolved new concepts of business which perhaps in practice may fall short of full realization but which can hardly fail to impress the fact that American industry, long established and conducted on high moral standards, is striving to attain still higher ideals.

The Paper Industry, North and South

THE future of the paper industry in the South is generally regarded as highly promising. In fact the development is such that some profess to believe that the mills recently built or in prospect seriously menace the industrial security of our Northern mills. Enthusiasm on the part of the new Southern companies is met by a feeling of questioning uneasiness in other localities where mills not so favorably situated are now operating.

Certain indisputable advantages exist for the industry in the South. Wood is readily available and replaces itself rapidly below the Mason and Dixon line; power is not wanting, neither is a potential source of labor. Present markets are within reasonable distance and new markets are bound to develop. Climatic conditions are more generally favorable to the industry in the South than elsewhere. Processes are now in use for the successful production of soda and sulphate pulps from such resinous woods as jack pine and gum.

On the other hand, it should not be forgotten that these pulps are unsuited for many uses. Sulphate pulp can be bleached only with difficulty and, being strong, finds its major use in wrapping paper and bags. Soda pulp fibers are soft, short, and may be bleached, being especially fitted for book and magazine papers. The fact remains that our largest item of paper tonnage, exclusive of board, consists of newsprint made of groundwood and sulphite pulp. Moreover, these pulps can be produced only from Northern species and until a new process is developed for pulping Southern woods, this situation will in all likelihood remain unchanged.

These considerations show that a movement of mills from North to South is not to be expected. The recent trend of the industry is indicative of an expansion rather than a migration. Whether competition in the South will prove permanently embarrassing to Northern sulphate and soda mills cannot be foretold. If foreign importations of pulp can be decreased, if our own demand continues to increase normally, the expansion of the industry in the South should not seriously injure the older industry in the North.

Research, Macaroni And Industrial Pyrex

THE potential importance of commonplace happenings in the conduct of industrial research is indicated by an incident in the development of household Pyrex. When the war cut off the supply of Jena glass it became essential to produce a substitute for the German product in this country. As in most other similar emergencies, American chemists and engineers found their way out of the difficulty. Under the leadership of Dr. Eugene Sullivan, of the Corning Glass Works, the glass now known as Pyrex was developed. Tests indicated that it might be used successfully in the fabrication of such ware as laboratory utensils and battery jars.

Commercial-scale production soon followed the preliminary studies. Almost as if by magic, battery jars began to disappear from the plant. Losses that were at first so slight as to be overlooked grew rapidly to the point where the curiosity of the men in charge was piqued, to say the least. It was difficult to conceive any considerable use for these jars that would prompt their theft.

It so happened that many macaroni-loving individuals worked at this plant. A still hunt disclosed that every one of these workmen was equipped with a stock of battery jars for the cooking of his favorite food in its many and varied forms. These men had used glass dishes successfully where porcelain enamel or crockery had previously been considered necessary. In this manner a use was discovered that was largely helpful if not absolutely essential to the success of the new industry.

This incident is not particularly novel, but it serves to point out that research, to be fully fruitful, must take into account apparently unrelated incidents as well as carefully tabulated laboratory data. It is easy to become so engrossed in such work that shortsightedness results. While it cannot be hoped that invaluable facts will often be discovered in this manner, the story serves to illustrate that constant alertness for the correlation of commonplace incidents in research may yield large dividends.

Contracts and Fair Play

A SUBSCRIBER writes to say that he has severed his connection as chemical engineer with a certain manufacturing company on account of an alleged breach of contract in which he felt that he had been unjustly treated. The case, as related, is a variation of the old theme of corporate greed and lack of conscience. It appears that our correspondent was employed to conduct research and experimental work and entered into the customary agreement to assign to his employer all rights to inventions, discoveries and patents. But when the company "had procured all the information connected with the inventions . . . with all data, they refused to make any financial consideration as provided by the agreement." Our correspondent regards this as a plain case of dishonesty and brings it to our attention because he believes that "if more of this kind of dishonesty among chemical and allied concerns were brought to light, less of it would be practiced."

It is impossible to say without a knowledge of all the facts whether our correspondent is justly aggrieved. If he is, there is redress in the courts for breach of contract. Assuming that 2 years of research yielded valuable knowledge, invention and discovery, the employee was entitled to his stipulated salary plus any additional compensation predicated on the achievement of results. If the nature and extent of the additional compensation were not stipulated in the contract, the employer might assume that he had discharged his full obligation by paying the employee's salary. It is a question of what the compensation was to be.

We cannot afford to overlook, however, the implication that companies are remiss in their treatment of technical men. Sometimes the tables are turned and the individual serves his own selfish ends instead of his employer. But in most of these cases where chemists and chemical engineers are concerned, the employer, rather than the employee, has been at fault and the individual has suffered. There are two remedies for the condition. One is legal and consists in exercising the utmost care in the drawing and signing of contracts. The other is moral, and will be realized only as business practices a higher standard of ethics.

Birdseye View of the British Empire Exhibition

An Empire Takes Account of Stock

The British Empire Exhibition in Wembley Presents a Magnificent Perspective of the Resources and Industrial Activities of the Many Countries in the Empire

By Our British Correspondent

EDITOR'S NOTE—It is appropriate that the British Empire Exhibition should have been opened with pomp and ceremony. It is an achievement in itself and a gesture—a gesture indicative of power, of beneficence, of vision, of co-operation. The development of these countries and continents of which this exhibition is a symbol is a great contribution to this civilization and it is the perspective of this development of resource and of industry that the exhibition pictures.

London, May 1, 1924.

IN spite of strikes of builders and electricians, and the refusal of the unions to permit overtime until a week before the opening date, the British Empire Exhibition was opened on schedule time. Because of these troubles, however, it is still incomplete, and it will be several weeks before all the exhibits are ready and the finishing touches are given to the buildings and decorations. Nevertheless, it is already abundantly evident that the exhibition, which is officially described as "designed to display the natural resources of the various countries within the empire, and the activities, industrial and social, of their peoples," succeeds in doing this in the most magnificent fashion.

In 219 acres of park land at Wembley, about 6 miles to the north of London, is displayed the whole empire in most realistic miniature, and the keynote of the whole is the amazing sense of perspective that is obtained, linking up raw materials and finished products, native crafts and the most modern manufacturing processes, natural resources of every kind and the consumer, education, health, government, transport, finance and every conceivable aspect of British civilization throughout the world.

Take coal. A model coal mine has been constructed, reached by means of a full-size winding head and cage, with a quarter of a mile of underground workings. This is no mere sideshow, but a practical demonstration of various types of seam and the latest means of mechanical coal getting, including safety appliances. Attached is a fine exhibit showing rescue apparatus, models of collieries, coal washeries, coke ovens and byproduct plants. Scattered through the exhibition may be seen samples of coal and coke from a score of districts, from Welsh anthracite to Nigerian brown coal. In the scientific section the results of the latest work on the constitution of coal are on view, while the display of coal products is extraordinarily complete. Some of the exhibits show the various stages and products in flow sheet form, and it is doubtful whether such a splendid and comprehensive display of intermediates, dyes, pharmaceuticals and fine chemicals ever before has been assembled.

Minerals and metallurgy are equally well represented. Apart from the fine exhibits of each country, the Imperial Mineral Resources Bureau has a centralized display in the Government Pavilion, where full information may be obtained concerning the metal and mineral resources of the empire. Gold-mining and diamond-washing plants will be seen at work, and there are many examples of mining in various parts of the world. The exhibits of deep boring plant are worthy of mention.

The chemical section has been organized throughout by the British Association of Chemical Manufacturers, and great credit is due to Mr. Woolcock, the general manager of the association, for the fine result achieved. As regards chemical engineering and chemical plant generally, the same degree of success cannot be recorded. In fact it must be admitted that British chemical plant makers have missed a great opportunity of showing what they can do. There is only one stand in the exhibition devoted solely to chemical plant, that of W. J. Fraser & Co., Ltd., of Dagenham, Essex. There are, however, other exhibits of full-size chemical plant, as for example one for the extraction of palm oil by Manlove, Alliott & Co., Ltd., of Nottingham, in the Nigerian section. In the scientific section there is a small chemical engineering exhibit arranged by Professor Hinchley, but this is not yet quite ready. Models of chemical plant are fairly numerous, but these are not as convincing as would have been a better display of full-scale apparatus.

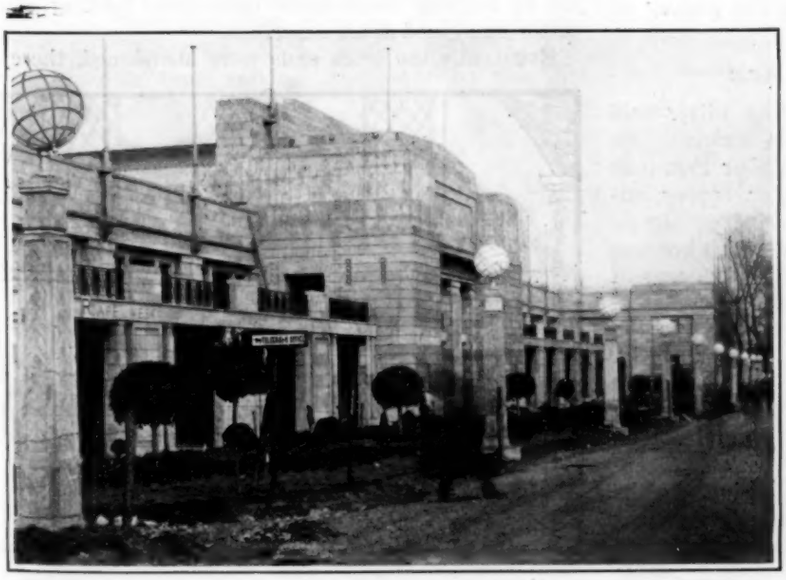
Entrance to Burma Pavilion

The British Empire Gas Exhibit occupies a fine section of the Palace of Industry, and if much of it is devoted to handsomely furnished rooms where the domestic gas fire is the chief feature, there is also a display of gas-fired hardening furnaces and of Bonecourt surface combustion.

In connection with the exhibition Brunner Mond & Co., Ltd., have made the announcement that their first large synthetic ammonia unit at Billingham is now in operation with a daily output of 100 to 120 tons of sulphate of ammonia, and that an ammonium nitrate plant is in course of erection. This is very interesting news, for the strictest secrecy has been observed regarding the progress at Billingham, the ultimate output of which is expected to reach 300 tons of liquid ammonia per day, or considerably more than that of Oppau.

Detailed reference to exhibits of special interest to readers of *Chem. & Met.* must be left for a later report when the arrangement and display has been completed and tuned up. However, enough has been said to indicate that American engineers who wish to obtain in the shortest possible time a comprehensive outlook over the whole British Empire as a going industrial concern with a view to seeing what and where they can buy from us or sell to us cannot do better than come to Wembley, and they will surely not regret doing so.

Very likely they will not see anything bigger or better in an individual way than they have at home, but for seeing the whole intricate maze of modern industry in its true perspective to the life of many peoples and countries this is the chance of a lifetime.



Palace of Industry

The Development of Modern Equipment for Nitric Acid Production

The Distillation, Condensation and Absorption Steps in the Sulphuric Acid-Niter Process Are Discussed From the Equipment Viewpoint

By F. C. Zeisberg
Chemical Engineer, E. I. du Pont de Nemours & Co., Wilmington, Del.

NITRIC ACID is made by at least three principal processes: by distillation of sulphuric acid and nitrate of soda, by direct combination of oxygen and nitrogen in the electric arc, and by ammonia oxidation. To keep within the allowable time limit, I shall consider only the distillation of sulphuric acid and niter as typical of nitric acid manufacture.

In the sulphuric acid-niter process of making nitric acid approximately equal parts by weight of 66 deg. sulphuric acid and 95 per cent Chilean niter are heated together. The nitric acid resulting from the action of the sulphuric acid on the niter is converted to vapor by the heat, distills over, and is condensed. Incidental to the temperature employed there is a certain amount of thermal decomposition of the nitric acid with the formation of a non-condensible gas, nitrogen peroxide. This can, however, be converted back to weak nitric acid by treatment with water in the presence of air.

If this manufacture is analyzed into its principal unit processes there result: the heating of the mixture, or distillation; the conversion of the resulting nitric acid vapors to a liquid, or condensation; and the recovery of the non-condensible decomposition products, or absorption. There are, of course, other minor unit processes such as bleaching, but these three are the main ones. Perhaps as good a way as any to see where we stand today with respect to the application of these three unit processes in the manufacture of nitric acid is to take them one at a time and trace the history of their development.

The Distillation of Nitric Acid

The earliest records available regarding nitric acid show that this material was known to the ancients. As early as 778 A.D. the Arab alchemist Geber mentions *aqua dissolutiva* made by heating saltpeter, copper sulphate and alum. This process was carried out in an earthenware pot heated by a charcoal fire. This pot was in communication with another pot, air cooled, and in this second pot the nitric acid accumulated.

For 800 years no essential change was made in the apparatus, though the ingredients were changed. Fig. 1 shows a nitric acid factory of 1580 A.D., described by Lazarus Ercker, Superintendent of Mines in Germany, Hungary and Tyrol. The still was still an earthen retort, the condenser a glass balloon, air cooled. There was no absorption of the decomposition products in the modern sense, only that portion of the nitrogen peroxide being recovered which dissolved in the condensed acid.

The first notable change in the still was the substitution of cast iron for clay. This was effected some time between 1720 and 1759, but I have not been able to find the name of the man who evolved this decided improvement. Clay required very slow and gentle heating and even then was prone to break, so that the distillation dragged out several days. Cast iron was very much less likely to break, thus permitting a material speeding up of the process. Though soluble in liquid nitric acid, cast iron is unaffected by nitric acid vapors and can hence be used in contact with these vapors as long as it is kept above their condensation point.

Evolution of Modern Retort

The first cast-iron retorts were mere replicas of their clay predecessors. As industry advanced they were made larger, but still retained an approximately spherical shape. Finally, they had to be made in several pieces in order not to overtax the limitations of the early foundries.

Then a curious thing happened. For some unknown reason it became the fashion to make the stills in the form of cast-iron cylinders, horizontally disposed, and the much simpler pot form was abandoned. These cylinders had open ends that were bricked in. One end was more or less permanent, but the other was removed at the end of every run in order that the niter might be charged in from the end. The heart-breaking job of keeping these brick ends from leaking can be better imagined than described.

Eventually the brick ends were abandoned, the cylin-

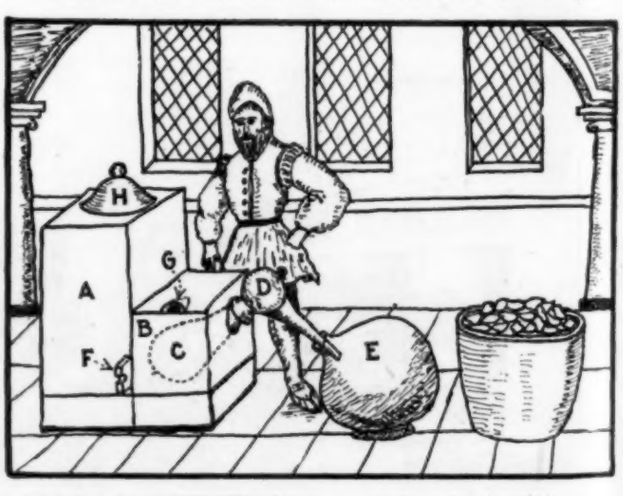


Fig. 1—Lazarus Ercker's Apparatus for Aqua Fortis
This is dated 1580 and the letters indicate the following: *A*—Heating tower. *B*—Side oven. *C*—Flask. *D*—Helmet. *E*—Receiver. *F*—Damper. *G*—Gas outlet. *H*—Tower cover.

From a lecture given at Carnegie Institute, Pittsburgh, Pa., March 21, 1924.

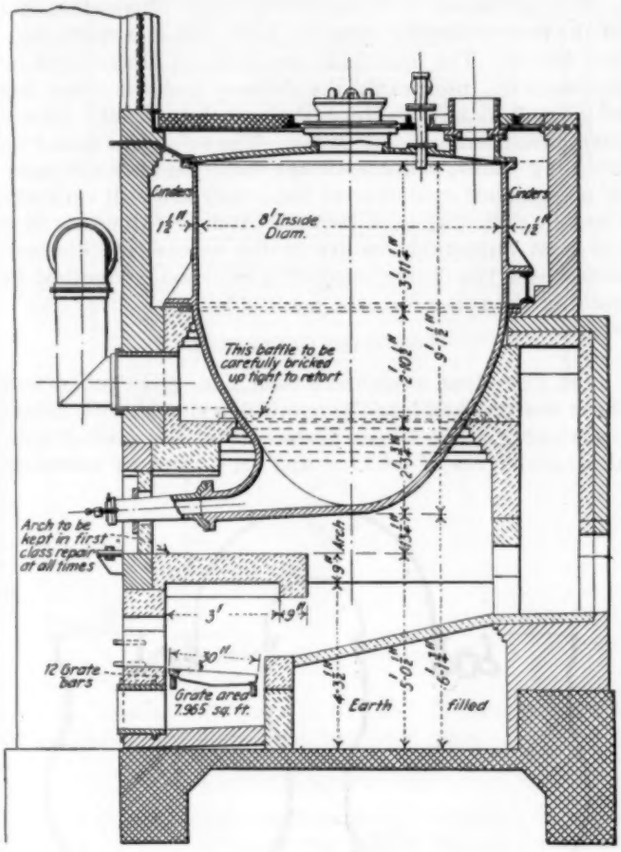


Fig. 2—Two-Pass Nitric Acid Retort Setting
Modern vertical type catenary retort

ders being cast with closed ends. These retorts were charged and unloaded from the top, the molten niter cake at the end of the distillation being ladled out by hand. To overcome this arduous task, trunnions were added in one design and the whole still was rotated at the end of the run, permitting the niter cake to drain out through the charging nozzle.

Why it took so long to come to the bottom outlet for the niter cake it is difficult to imagine. This, however, was the next improvement, the stills now being immovably fixed in their setting, charged from the top, and discharged from the bottom.

Increasing the Size of the Batch

Along with these various changes in design there was a constant increase in size. Where the early retorts of Geber held but a few pounds of material at most, the horizontal retort of 1910 was capable of taking a 6,000-lb. charge of niter and an equal weight of sulphuric acid. Indeed, the size had increased to such an extent that it had again become necessary to make the retort in two parts, partly because of foundry limitations and partly for economy's sake, because the lower half of the cylinder wore out much more rapidly than the upper and could be replaced several times to one top.

Difficulties with the joint between these two sections finally led to a return to the old pot type of retort, and the modern retort is the result. The first of these so-called vertical retorts installed by the du Pont company was put in in 1912, though they had been in use elsewhere some years before this.

Fig. 2 shows one of these modern vertical retorts, rated at 6,000 lb. of niter. The bottom is approximately hemispherical and is made somewhat thicker than the sides. Under normal operation its life is about 1,000 charges, but cases are on record where they have lasted 1,800 runs, and they have been known to fail utterly below 100 runs. It will be noted that there is no joint below the level of the charge, where the molten niter cake can get at it, except the comparatively small joint between the discharge nipple of the retort and the niter cake nozzle. This joint is faced, and is easy to keep tight with an ordinary asbestos gasket.

There has been no notable improvement in nitric acid retorts in more than 10 years. It is true that stirring equipment has been added by Hough in the vacuum process, the apparatus for which is manufactured by the Buffalo Foundry & Machine Co., but the retort is essentially the same as that of Fig. 2. Fig. 3 shows the drive of the stirring mechanism projecting through the top of the retort setting.

While a man treads on dangerous ground when he assumes to prophesy, I am inclined to predict that the next improvement in distillation as applied to nitric acid manufacture will be with the setting and not with the retort itself. A modern retort setting is most uneconomical of fuel, and is by no means all that can be desired from the standpoint of yielding a uniform, stainfree heating of the retort, so that much room for improvement exists here.

Condensation Equipment

Turning now to condensation, we see that even as recently as 1580 no real provisions for condensation were made. Reverting to Fig. 1, the glass balloon was luted as tightly as possible to the retort, and the distillation was conducted only as rapidly as the evolved vapors could condense in the balloon by radiation of the resulting heat to the air. The first improvement in the art of condensation was the use of a series of earthenware condensing vessels connected together, open to the air on the end away from the retort. These vessels were approximately spherical in shape, were connected by return bends on top, and were simply air cooled. Fig. 4 shows the general design. If it had been particularly designed for the purpose of cutting down the transfer of heat from the contents to the surrounding air, it could hardly have been improved. The shape is almost

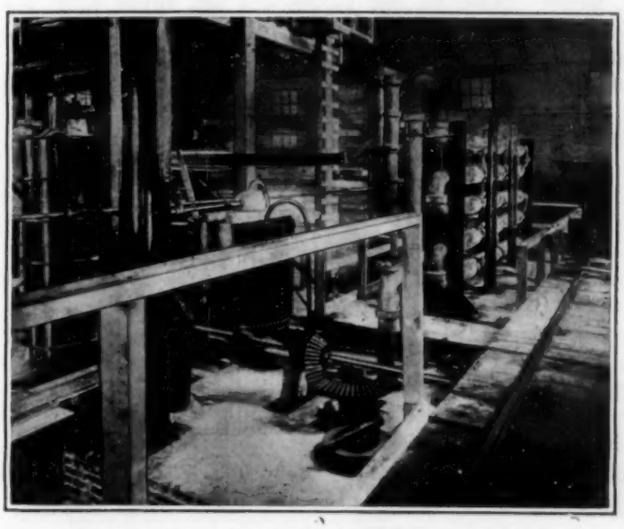


Fig. 3—Hough's Stirred Retort for Nitric Acid

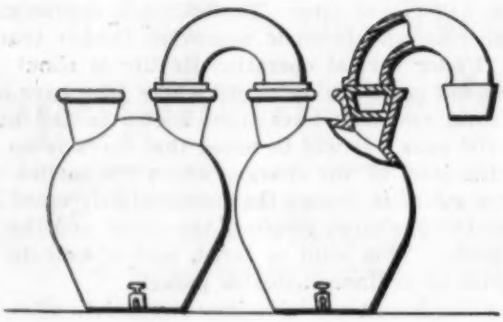


Fig. 4—Nitric Acid Tourill
Showing earlier type ground fitting

spherical, and geometry teaches that the sphere is the shape having the least amount of surface for a given volume. The material is earthenware, a poor conductor of heat, and mechanical considerations dictate making the walls fairly thick. I do not know just when this type of condensing apparatus was first used, but I saw an installation still operating in California as late as 1916.

One of the first improvements in the design of this type of condensing equipment was the addition of a series of balloons above the tourills, as shown in Fig. 5. The next was a simple lengthening of the connecting return bends. Gradually the tubes were made longer and the tourills more subordinate until there was evolved the so-called Guttmann condenser, shown in Fig. 6, which enjoyed much popularity for a long time, especially in Europe.

In the United States the development was somewhat different. I have heard my friend Dr. Edward Hart, of Easton, Pa., tell of his early experiences in the manufacture of nitric acid. Realizing that the tourill condensing system was most unsatisfactory, his first attempt at improvement was to fit as many large, laboratory, Liebig condensers to the outlet pipe of his retort as he could find the room to set up. When the retort was all charged and the condensing water properly flowing, it was his practice to start the fire under the retort and then leave the building until the fire had gone out and the distillation was completed, for during the run nothing could be seen except clouds of red fumes surrounding the whole equipment.

Being chased by red fumes did not agree with his ideas of the proper activities of a chemical engineer, and the result was the final perfection, in the early '90s, of the Hart condenser, one of the most notable steps in the improvement of nitric acid manufacture that had been made up to that time.

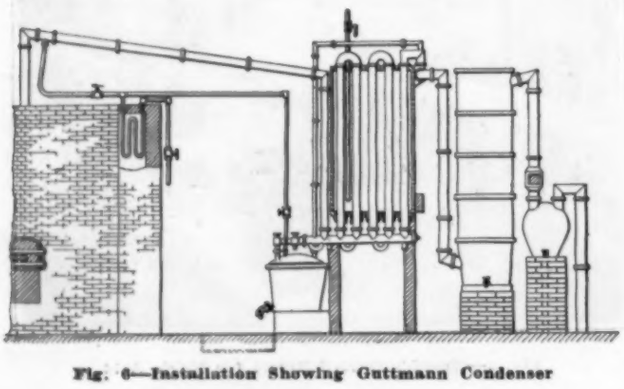


Fig. 6—Installation Showing Guttmann Condenser

This condenser is shown in Fig. 7, an illustration, not of the first condenser made by Hart, but of a more modern design. The manifolds are made of silicon iron or earthenware, preferably the former, and the tubes are of glass, 3 in. in diameter and about ⅛ in. thick. Lately they have been made of Pyrex. The tubes are cooled by trickling water, and despite the fact that they are made of a very poor conductor of heat, they are still very efficient in removing heat because of their thinness. Not the least important feature in the success of this condenser was the development of a satisfactory method of packing the tubes into the manifolds.

The Hart Condenser

The first Hart condensers used 1-in. glass tubes, and these were packed into the manifolds simply with asbestos wicking. The larger modern tubes are packed with alternate layers of wicking and an acid-proof asbestos-

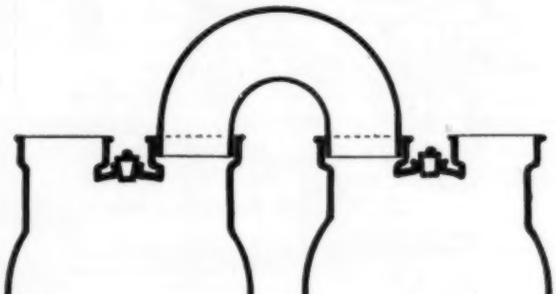


Fig. 5—Nitric Acid Tourill
Showing modern simple lute

oil putty that remains soft for a long time and thus takes care of expansion and contraction.

Lately the tendency in nitric acid design is away from the Hart condenser, silica and silicon iron S-bends being used instead. Fig. 8 shows such a condenser diagrammatically. The S-bends in this case were of Duriron, 6 in. in diameter by about 6 ft. long, and two series were used in parallel. The advantage of an S-bend condenser over the Hart lies in a great reduction in the number of joints and in the fact that the joints in the S-bend are horizontal and therefore much less likely to leak than the vertical joints in the Hart. Either silica or silicon iron is satisfactory for the construction of this type of condenser.

There have been a number of other condensers designed, but time will not permit of their discussion. Some of these possess advantages, but none of them has been in such extended use as those described.

It will be observed, in looking back over the condensers mentioned, that the design has been greatly influenced by the limitations of the materials it was necessary to use in order to resist the extraordinarily corrosive effects of the nitric acid and the impurities that accompany it. In every case the material is brittle and can only be molded or cast. Until some reasonably cheap ductile alloy can be developed that is really resistant to nitric acid, it is not likely that the design of a nitric acid condenser will depart materially from the S-bend principle. If such an alloy can be found, the usual type

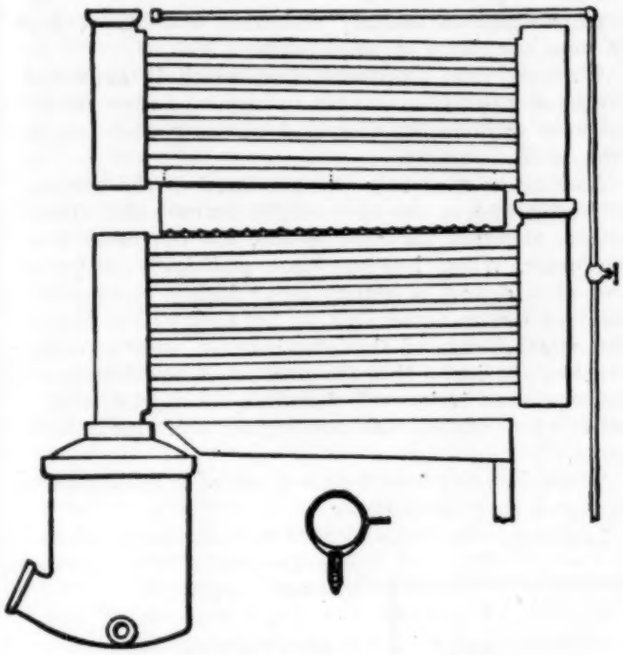


Fig. 7—Hart Nitric Acid Condenser

of multi-tubular condenser so extensively used in rectification design can hardly be improved upon.

Absorption Trouble

In taking up absorption it is hardly necessary to point out that up until Ercker's day and in the early days of the use of tourills for condensation, no distinction was made between condensation and absorption, these two processes occurring side by side. Later, when it was realized that the first was a purely physical process requiring merely the removal of heat, while the latter was a chemical process requiring in addition to the removal of heat the combined presence of water and oxygen (or air), the tourill series was separated into two sets, the first used purely for condensation and the second, by half filling the tourills with water before the beginning of the run, for absorption. It was a natural step to add an absorption tower, down which a small stream of water trickled, to catch the last of the fumes escaping from the tourill series. It was soon realized that the tower was a much more efficient piece of apparatus for the conversion of nitrogen peroxide to nitric acid than the tourill, and as the various new forms of condenser were evolved, they were almost always used in connection with one or more absorption towers.

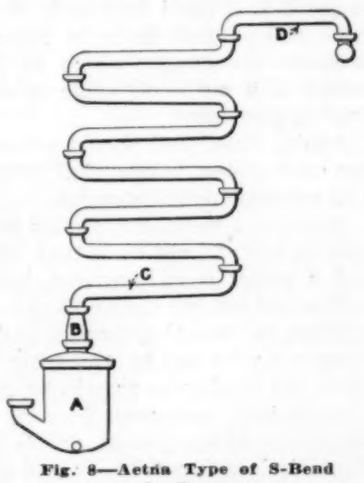


Fig. 8—Aetna Type of S-Bend Condenser

Many different forms of tower have been proposed and the special packings with which these towers are to be filled are legion. It is impossible to go into the details of packing here, but it is perhaps well to mention one point. Towers must almost of necessity be made of earthenware, for so far nothing else has been found that will stand up under the severe conditions that obtain except a few natural stones, among them several granites. The point is that the filling material should as nearly as possible have the same coefficient of expansion as the tower in which it is placed. The old practice of using broken quartz in earthenware towers resulted inevitably in cracked tower sections, because the quartz, with its low coefficient of expansion, settled while the towers were operating and hot and when the tower cooled off a wedging action caused the fracture. In the early towers, when several were used in series, it was the practice to add water on top of the last tower of the train, catch the weak acid draining from the bottom and carry it in carboys to the top of the next tower, where the process was repeated, until it was drawn off as finished acid from the bottom of the first tower. Thus the absorbing liquid passed only once down each tower. Now it is the general practice to maintain a continuous circulation over each tower by means of a pump or air-lift, advancing the acid forward counter-current to the gas flow either by the adjustment of valves that bypass a portion of the circulating liquid, or, better, by overflow pots that allow the acid to advance automatically as fast as it collects beyond a certain amount. Fig. 9 shows a modern chemical-ware absorption tower, 30 in. in diameter by 15 ft. high, equipped with an overflow pot and two air-lifts, or pulsometers, for maintaining a vigorous circulation over the tower.

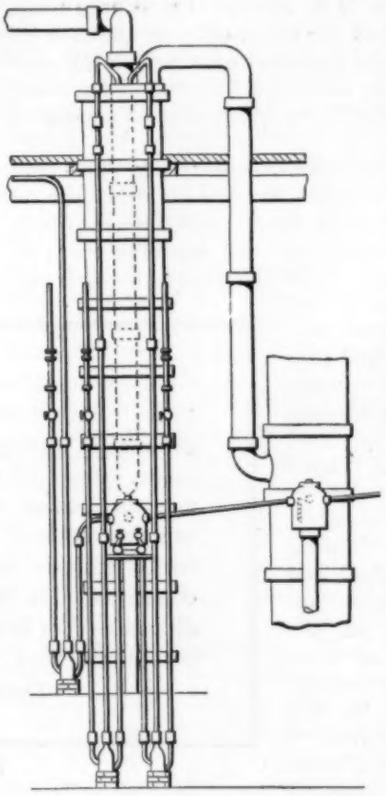


Fig. 9—Absorption Tower

Editor's Note: The second part of Mr. Zeisberg's lecture, dealing with the contact sulphuric acid process, will be published in a subsequent issue of *Chem. & Met.*

Boiler-Setting Refractories Specifications

At a recent conference of the committee on refractories of the Federal Specifications Board the tentative specifications for boiler-setting refractories were revised to meet the suggestions submitted by the industry and by government departments since their promulgation as "tentative." At the conference it was further decided to take up the preparation of specifications for fireclay used as a mortar and for the so-called "plastic" refractories used in building rammed-up boiler linings.

What Is Iron, What Is Steel?

New Short Definitions Offered in the Light of Modern Developments

By Albert Sauveur
Professor of Metallurgy, Harvard University

THE incongruity of calling steel a product that represents the nearest approach to the element iron commercially obtainable is so glaring that it once more brings forcibly before us the much-debated question of the nomenclature of iron and steel and reveals the confused and unsatisfactory condition in which it has been left in spite of the labors of many committees appointed to clarify it.

Some still contend that the commercially pure iron I have in mind, known to the trade and to science as Armco Ingot Iron, should be labeled steel, because it is produced in a liquid condition. The manufacturers of this metal have selected for it the name "ingot iron," and who can deny that if any metallurgical product was ever entitled to be so described it is indeed this practically carbonless and manganeseless product of the open-hearth furnace? The term "ingot iron," however, which is the equivalent of the German term *Flusseisen*, was proposed by Dr. Wedding to designate bessemer steel, and in Germany it has been applied to the product of the bessemer converter, at least when not too highly carbonized. Instead of objecting to this iron being called ingot iron, if we followed the dictates of common sense, we should expel all low-carbon steels from that class and admit only Armco Ingot Iron or similar products. Indeed, is not this iron the only real ingot iron ever commercially manufactured?

> Many definitions of "steel" and "iron" have been presented and discussed during the past few years. Some of them are voluminous and replete with technical detail, but none of them has proved to be entirely satisfactory to all concerned. Dr. Sauveur "offers for discussion" in four short sentences definitions that are both simple and complete.

Attempts have been made to distinguish between wrought iron and steel (1) by classifying as steel all malleable ferrous products which could be hardened by quenching, and as wrought iron those which could not, regardless of the process of manufacture; and (2) by classifying as steel all malleable products obtained in a fused condition and as wrought iron those obtained in a pasty condition, regardless of their chemical composition and physical properties. The first classification prevails to some extent in Germany, where, however, as already stated, the mild varieties of steel—that is, those which cannot be hardened by quenching—are known as *Flusseisen*. The second classification is generally followed in the United States, England and France, where it has been accepted not because it satisfies but as the only apparent way out of the difficulty.

As secretary of the international committee "on uniform nomenclature of iron and steel," appointed in 1910 by the International Association for Testing Materials and of which Professor Howe was chairman, I took an active part in the deliberations, and in common with other metallurgists, in a spirit of resignation, I accepted the following definition proposed by the committee as the best solution it could offer:

Steel—Iron which is cast from the molten state into a mass which is usefully malleable, initially at least, in some one range of temperature.

Wrought Iron—Malleable iron which is aggregated from pasty particles without subsequent fusion and contains so little carbon that it does not harden usefully when cooled rapidly.

So long as steel only was produced in the bessemer converter and in the open-hearth furnace this classification, although far from sound, did not cause much confusion. When, however, iron practically carbonless and of a degree of purity never before commercially attained was manufactured by the open-hearth process, the shortcomings of this classification were strikingly revealed; to insist that the product of the open-hearth furnace, even if it were chemically pure iron, shall be called steel offends our intelligence and our common sense.

These thoughts have led me to offer for discussion the following short definitions:

1. *Commercial Iron*—Commercial iron is the element iron as pure as it can be commercially produced.
2. *Ingot Iron*—Ingot iron is commercial iron which has been produced in a fluid condition and cast.
3. *Wrought Iron*—Wrought iron is a ferrous metal which is malleable and which has been produced from a pasty condition.
4. *Steel*—Steel is an alloy of iron and carbon, usually containing substantial quantities of manganese.

Following this classification, such a material as Armco Ingot Iron may be further defined as "ingot iron" produced in an open-hearth furnace and containing not more than 0.02 per cent carbon and not more than 0.035 per cent manganese.

If, accepting my nomenclature, it is asked that a line be clearly drawn between ingot iron and steel, I venture to recall that ingot iron as here defined differs sharply from the mildest steels in regard to their respective manganese contents, which in ingot iron should not exceed 0.05 per cent, while steel seldom contains less than 0.20 per cent.

Again, ingot iron should not contain more than 0.03 per cent carbon, while steel seldom contains less than 0.05 per cent of that element.

Between a metal containing not more than 0.03 per cent carbon and not more than 0.05 per cent manganese and a metal containing not less than 0.05 per cent carbon and not less than 0.15 or 0.20 per cent manganese or even, in exceptional cases, as little as 0.10 per cent, there is a wide gap by which ingot iron and the mildest steels can readily be chemically differentiated.

Ingot iron, moreover, because of its extremely low percentage of manganese, unless indeed it contains considerably less than 0.02 per cent of sulphur, is red-short within a certain range of temperature, whereas low-carbon steel, owing to its much larger percentage of manganese and although it may contain considerably more sulphur, is free from red-shortness.

In the absence of the thermal critical point A_1 when iron contains less than 0.03 per cent carbon and in the absence of pearlite in its micro-structure, we might

find an additional means of distinguishing between ingot iron and mild steel.

A sound and rational nomenclature of our ferrous products is of importance alike to producers, to consumers and to scientific men interested in the metallurgy of iron and steel. The problem should be approached in a spirit of service and of fairness devoid of commercial considerations, of technical sophistry and of ingenious attempts at begging the question.

Colloidal Clays for Bleaching Oils

The properties of colloidal clays, as revealed in recent investigations at the New Brunswick station of the Bureau of Mines, are such that growing industrial importance of these substances is considered probable. Two such clays are bentonite and montmorillonite.

Bentonite is a hydrous aluminum silicate combined with varying amounts of the alkalis sodium and potassium and the alkaline earths calcium and magnesium. No chemical formula can be given for bentonite, as its chemical composition is too indefinite.

Montmorillonite is a hydrous aluminum silicate combined with alkalis and alkali earths, and is very similar to bentonite, so much so that it is impossible to make a definite decision and state whether a mineral specimen under examination should be called bentonite or montmorillonite.

One of the most characteristic properties of bentonite is its ability to absorb large quantities of water and to form colloidal, jelly-like suspensions when mixed with water. Some forms of bentonite do not form these suspensions.

In addition to the uses of bentonite listed in Reports of Investigations Serial 2289, it has been discovered that an excellent material for bleaching oils may be prepared from this material. California bentonite is used, and, to avoid the mechanical difficulties which arise in handling the jelly-like colloidal suspension, a bentonite is chosen which does not form these suspensions. This bentonite or montmorillonite is treated with sulphuric acid, which removes the alkalis, alkaline earths and some of the aluminum, leaving a residue composed of extremely fine grains of aluminum silicate. This material when substituted for fullers earth displays remarkable efficiency in bleaching oils; in fact, in some tests it has shown a capacity sixteen times that of corresponding amounts of fullers earth for this purpose.

Use of Glue for Coating Investigated

The Bureau of Standards has recently been continuing the study of the possibility of using glue in the coating material for paper. Different grades of glue have been studied and apparently the lowest grade gave as good results so far as adhesive quality is concerned as any of the better ones. This indicates that lower grade glues than those previously considered may be suitable for this work, or at least that it may be possible to lessen the amount of the higher grade glues used in the coating mixture. The elimination of the mottled appearance of the coating has also been studied. Apparently this is not due to any characteristic of the paper structure but is caused by air bubbles held in suspension in the coating. The ordinary foam preventives seem to have little beneficial effect and further study will be required to overcome this difficulty.

Continuous Grinding In the Ceramic Industry

New Plant at Los Angeles Adopts Advanced Methods Perfected in Field of Hydrometallurgy and Ore Dressing for the Fine Grinding of Clay, Feldspar and Silica

SUCCESSFUL penetration of modern hydrometallurgical and chemical equipment into the non-metallic field is evidenced by the adoption of standard units, such as the Hardinge mill, the Dorr classifier and Dorr thickener, and the American vacuum filter, in the new plant of the American Grinding Co., recently started at Vernon, Los Angeles. Credit for the design of this, the first unit, belongs to G. Ray Boggs, of the Empire China Co., Burbank, Calif., whose contact with the ceramic industry, subsequent to experience in milling and hydrometallurgical work, prompted investigations into the possible benefits to be derived by the scientific preparation of the higher-grade materials used in the manufacture of china ware. This investigation took account of the additional possibility of producing high-grade and finely ground feldspar, clay and silica of characteristics so uniform that a demand would arise from other industries using these products. A survey of the field showed that such products are in demand by the paint, paper, rubber, soap and oil-refining industries—to mention but a few of the possible outlets.

Vernon, where the new plant is situated, adjoins Los Angeles. Spur lines from the Union Pacific and Santa Fe railroads bring the raw material, which is crushed or broken to about ¾ in. The clay, or kaolin, comes from Boyd, Nev.; the feldspar from Campo, Calif.; and the silica from Ralston, Nev.

At present the equipment is being operated to handle only one product at a time, although units to handle each separately will be installed very shortly. The raw material (Fig. 1) is elevated from the level of the receiving floor by belt and bucket elevator, and delivered to a bin holding about 100 tons. From here it passes to a belt feeder, the speed, and consequently the amount of material passing, being controlled by a Reese variable-speed pulley. The belt delivers to the feed hopper of a Hardinge conical mill (Fig. 2), equipped with the usual type of scoop, sufficient water being added to insure efficient grinding. The mill is lined with silex (stone) blocks; and a load of 8,500 lb. of Danish pebbles is maintained. The effluent pulp passes to a sump, from which it is lifted by a triplex Dorrco diaphragm pump

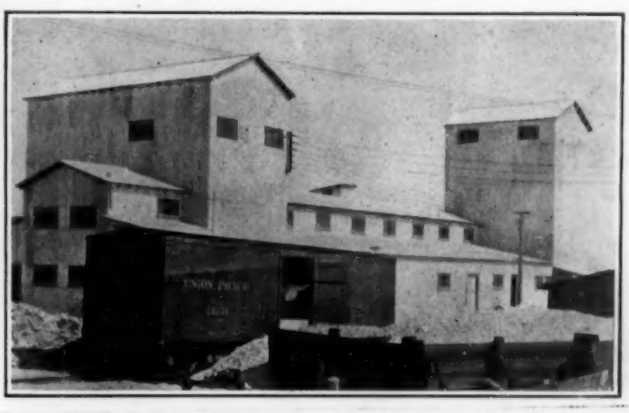


Fig. 1—Delivery Platform for Silica, Clay and Feldspar

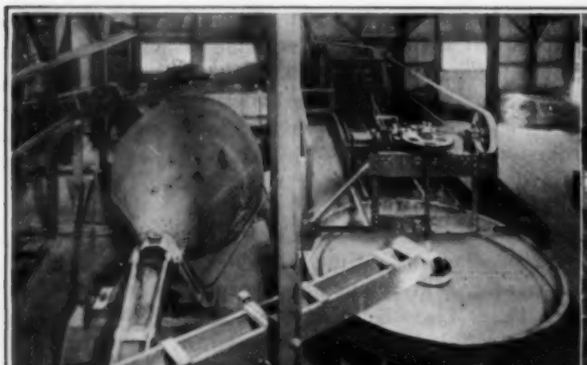
and delivered to a Dorr bowl classifier, 6 ft. in diameter (Fig. 2 and 3), the oversize returning to the Hardinge mill. The overflow from the classifier goes to a Dorr thickener, 24 ft. diameter (Fig. 4), which is used as a second classifier when kaolin is being ground, the underflow passing back to the mill. The overflow, of the finest water-floated material, goes by gravity to a second Dorr thickener, 54 ft. diameter, in which the material is seasoned and dewatered. The tanks are of redwood, manufactured by the Pacific Tank & Pipe Co., San Francisco. A Dorrco diaphragm pump delivers the sludge to a twelve-leaf American vacuum filter (Fig. 5), the discharge from which drops to a small hopper, to be delivered as required to galvanized-iron trays, each 1½ ft. by 2½ ft. by 2 in. deep, which are stacked on trucks for passage through the tunnel drier.

For the grinding of silica and feldspar, the use of the second Dorr thickener is avoided. For kaolin, however, where extensive settling area is necessary, the additional time of contact with water aids in the development of the colloidal properties of the material by which its value in ceramic work is largely determined.

For use in local potteries, the clay slip is shipped wet, as it comes from the filter. For the production of dry products, clay, feldspar or silica, the tunnel kiln used has proved efficient and satisfactory, being designed to be operated on the humidity system, whereby initial casehardening of the material is prevented by the maintenance of sufficient humidity at the feed end of the apparatus until the temperature of the material is raised throughout each lump or portion to a point at which dry heat can be successfully applied.

The capacity of the first unit now in operation is about 50 tons per 24 hours, the final products passing a 200-mesh screen. The design of the plant is such that it will be possible to increase the output to 100 tons per day. The effectiveness of the method of comminution in use is evidenced by the fact that the clay slip resulting is said to equal that from the best imported English china clay. Extended weathering is being displaced by scientific grinding to a point hitherto deemed impracticable, the result being a standardized product, already in mixed form, which is proving acceptable in pottery plants.

Water consumption at the Vernon plant is nominal, depending almost entirely on the amount of water in the discharged filter cake. No electrolyte, which might interfere with the character of the ultimate product, is used to hasten settlement. The total power consumption on the basis of 50 tons per day is 100 hp. The superintendent of the plant is H. S. Montgomery, formerly associated with the New Cornelia Copper Co. in the operation of the 5,000-ton crushing, leaching and electrolytic copper recovery plant at Ajo, Ariz.



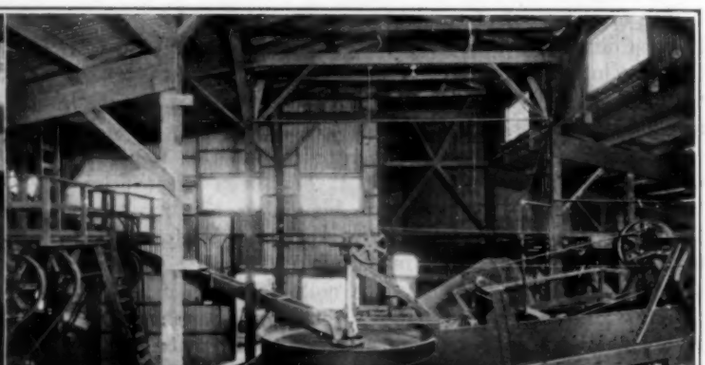
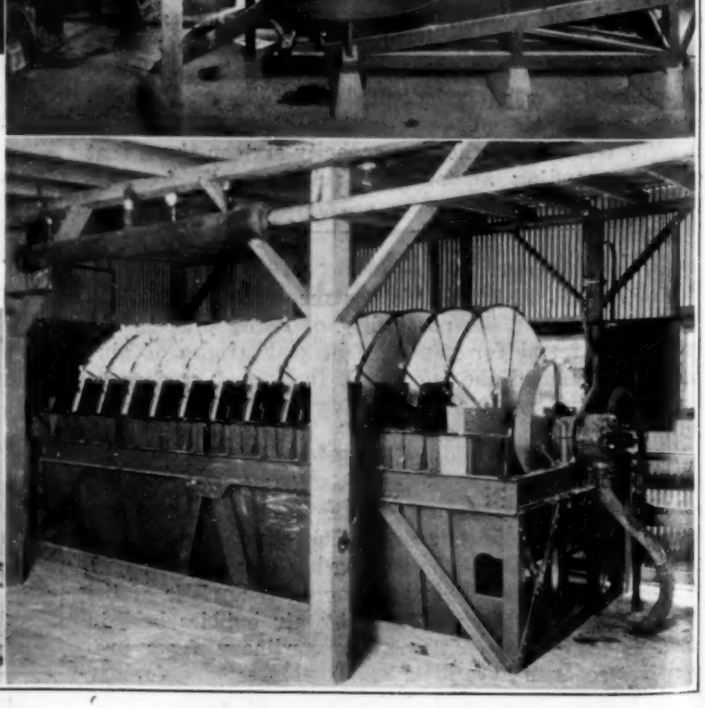


Fig. 2 (Upper Left)—Interior View of Plant, Showing Dorr Bowl Classifier and Hardinge Mill

Fig. 3 (Upper Right)—Another Interior View

Fig. 4 (Lower Left)—Dorr Thickeners

Fig. 5 (Lower Right)—American Continuous Vacuum Filter



Problems in the Refining of Cracked Distillates

How the Sulphuric Acid-Soda Treatment Is Modified in Order to Obtain Marketable Gasoline From the Products of Cracking Processes

By Jacque C. Morrell
Chemical Engineer, Universal Oil Products Co., Chicago, Ill.

THE commercial criteria to be met in the production of refined motor fuels are in general the absence of color, i.e., a water-white product; sweet odor or absence of any objectionable odors; and stability under marketing conditions. The last refers to the development of color, cloud or odor during storage or handling.

The remarkable results obtained in the cracking of heavy oils such as those of the Panuco, Venezuela, California, Borneo, Smackover and Texas coastal types have practically changed the aspect of gasoline production.

The cracking of heavy oil charging stocks of Mexican and South American origin, especially the Panuco crudes or residuum obtained therefrom, gives us what amounts to practically a new type of product. The high sulphur content of these oils will of necessity produce a gasoline upon cracking that is relatively high in sulphur. The product also contains a relatively high percentage of unsaturated compounds in common with all cracked gasolines. Contrary to the general belief, this product is remarkably stable, and samples of it have retained their water-white color and sweet odor over very long periods of exposure to all sorts of conditions.

"Crack or be cracked!" is the way some one aptly summarized the predicament of the petroleum refiner. Most of the refineries have naturally cast their lots with the several cracking processes that during the past few years have almost revolutionized the technical as well as the economic status of the oil industry. But with this striking progress has come the necessity for modifying standard practice in order to refine the new types of products resulting from these processes. Satisfactory and economical chemical treatment of certain cracked distillates has been a most refractory problem. This article outlines the general principles involved and suggests some useful changes in the usual refining methods.

In general cracked distillates contain color- and sometimes cloud-forming compounds of olefine, diolefine or terpene characteristics that demand particular attention in the refining process for their removal. Undesirable sulphur compounds may also be present. The reagents most generally used for the refining of mineral oils of any type are sulphuric acid, sodium hydroxide, litharge and, of course, water. These were selected because of their reaction either alone or in combination with one or more of the above-named groups.

The following generalizations on treating cracked distillates from all types of charging stocks are the result of observation and application of the simple principles involved in both the laboratory and the plant.

The methods of treating shown below are extensions of those previously outlined by the writer as co-author. (Morrell and Egloff, *Refiner and Natural Gasoline Manufacturer*, vol. 2, No. 7, July, 1923; Egloff and Morrell, *Chem. & Met.*, vol. 29, No. 2, July, 1923.)

Practical Treating Methods

(1) Applicable only to types of oil treated with least difficulty.

(*a*) Agitate with sulphuric acid (usually 66 deg. Bé.). Settle and draw off sludge.

(*b*) Wash well with water.

(*c*) Treat with solution of sodium hydroxide followed by short water wash.

(*d*) Distill in the presence of steam, preferably introducing the steam in the oil body. The steam distillation may be assisted by a low fire. It is preferable to make use of a continuous or semi-continuous method in distilling. The latter avoids long-continued heating of the cracked distillate, which is undesirable in most cases.

Method 2, given immediately below, is the most desirable and most generally applied method for the treatment of cracked distillates. Inspection will show that it is practically the same as method 1, with the exception of a plumbite treatment (litharge dissolved in sodium hydroxide) replacing the plain caustic soda.

(2-*A*) (*a*) Agitate with sulphuric acid (15 to 20 minutes for 1,000-bbl. batch). Settle and draw off sludge.

(*b*) Short water wash, usually 5 to 10 minutes.

(*c*) Agitate with plumbite solution until sweet to "doctor" test[1] (20 to 30 minutes for 1,000-bbl. batch).

Do not use sulphur in this treatment. If the suspension usually formed on addition of the plumbite solution breaks on blowing or agitating, allow to settle and draw off. Under any circumstances draw off the plumbite solution.

(*d*) Wash for short period with water, agitating if suspension is removed, but simply showering if suspension is still present to avoid emulsion.

(*e*) Distill in the presence of steam following the precautions shown in method 1, preferably using a continuous method.

(*f*) If gasoline comes over sour to doctor test, sweeten by treatment with plain caustic soda solution, the more dilute the better.

The plumbite solution consists of litharge dissolved in caustic soda. Usually from 0.05 to 0.2 lb. of

[1] The reaction of the plumbite solution with gasoline on the addition of sulphur is known as the doctor test—a widely used gasoline specification test.

litharge per barrel of distillate is used, dissolved in 16 to 30 deg. Bé. solution of caustic soda, 2 to 5 per cent by volume of oil treated. For some unusual cases, up to 0.75 lb. of litharge per barrel of oil may be used to get the concentration effect. As high as 10 per cent by volume of solution may also be used. The amount of litharge to be used is determined by trial, using the smallest quantity necessary to render the oil sweet to the doctor test.

Under any circumstances the plumbite solution is recovered by allowing the suspended material to separate upon standing and drawing off the clear liquid. Make-up litharge may be added upon re-use.

(2-*B*) In some cases it is desirable to precede the plumbite treatment shown in 2-*A* by a caustic wash followed by a short water wash. This is especially advisable where it is undesirable to carry over too much suspended material which is formed on the addition of plumbite and which does not break out upon agitation or standing. In a great many cases such caustic treatment preceding the plumbite treatment will remove a great deal of the sweetening and stabilizing burden from the plumbite. In addition, under the same circumstances the formation of a suspension is prevented.

(2-*C*) Mixtures of cracked distillate and straight run benzine may be treated according to 2-*A* and 2-*B*. If the straight run benzine does not require acid treatment, it may be mixed with the acid-treated cracked distillate, water-washed, plumbite-treated, etc., as in 2-*A* and 2-*B*. The acid-treated cracked distillate may have a short water-wash before mixing if desirable. Various other combinations making use of the general principles of acid-treatment, water-wash, plumbite-treatment (no sulphur) and water-wash may suggest themselves.

Method 3 refers to certain cracked distillates that cannot be successfully treated by the above methods. This method has been found particularly useful in the treatment of cracked distillates from heavy oils of high-sulphur content such as Mexican, South American, etc. Some California oils also respond most readily to this treatment.

(3-*A*) (*a*) Plumbite treatment using 20 to 30 deg. Bé. caustic soda solution by volume of oil treated containing 0.2 to 0.7 lb. of litharge per barrel of oil. Agitate, settle and draw off. Part of the plumbite solution is recoverable.

(*b*) Shower with water, settle and draw off. (Do not agitate.)

(*c*) Treat with sulphuric acid, preferably adding a small portion previous to the main addition to act as water remover. The acid also breaks any suspension formed owing to the plumbite reaction, thus being a perfect substitute for sulphur at this stage.

(*d*) Water-wash, the more thorough the less caustic used for neutralization subsequently.

(*e*) Caustic treating (1 to 5 per cent of 8 to 12 deg. Bé. solution by volume of oil treated).

(*f*) Short water-wash.

(*g*) Distillation in the presence of steam, using the precautions previously cited. Sweeten if necessary after distillation with dilute caustic solution.

(3-*B*) (*a*) Treat as in 3-*A* with the following changes. A smaller quantity of plumbite solution, preferably around 30 deg. Bé. e.g., about 3 per cent by volume of oil containing about 0.1 to 0.3 lb. of litharge per barrel of oil treated.

(*b*) Plumbite solution used as in 2-*A*; i.e., 3 to 5 per cent by volume 16 deg. Bé. caustic containing 0.1 to 0.2 lb. litharge per barrel of oil treated is substituted for the caustic following the acid in 3-*A*. A short water-wash precedes this plumbite treatment. The concentration of the latter plumbite may be varied to suit conditions.

The order of treating would then be: Plumbite (about 30 deg. Bé.); water shower; acid (preferably adding small quantity before the main treatment); water-wash (short); plumbite-treatment (about 16 deg. Bé.); short water-wash; and distillation in the presence of steam following the previously cited precautions. If the gasoline is not sweet at this stage, treat with plain caustic soda solution, the more dilute the better.

Method 3-*B* is useful for certain refractory cases, which cannot be handled by any of the previous methods. It is as economical as 3-*A* and is therefore preferable.

The keynote to and general purpose of the above alternate application of the simple reagents sulphuric acid, sodium hydroxide and litharge is the attaining of desired results with the elimination of the use of sulphur in the treating process.

Guislin (*Petr. Rev.*, vol. 28, p. 486) and others have shown that sulphur is soluble in hydrocarbons; and Friedmann (*Petr.*, vol. 2, pp. 693-7, 1916) and others have shown that sulphur reacts readily with hydrocarbons. The presence of elementary sulphur and of unstable sulphur compounds, as is readily understood, is very undesirable in a gasoline for practical as well as for other reasons.

Under certain conditions of distillation and with certain types of cracked oils, although a water-white and sweet product is obtained by treating according to one of the above methods, it may be unstable, especially on continued exposure to direct sunlight.

In cases of this kind, which are not usual, a final treatment with fullers earth or other adsorbent earths will give a stable product under practically all conditions. This may be applied in one of two ways:

(*a*) Filtration.

(*b*) After treating with dilute caustic (if necessary), water-wash, allow the water to settle and draw off. Add while agitating a very small quantity of fine mesh fullers earth. Then add the remainder of the earth (a total of from 0.5 to 1 per cent by weight of oil), agitate, settle and draw off. To remove the very fine earth that remains suspended in the gasoline, wash and agitate with water. The water probably removes the earth by selective wetting and adsorption of the water by the earth.

Since 66 deg. sulphuric acid is most easily available and convenient, it usually meets all of the acid requirements of the petroleum refiner. Cracked distillates from mid-continent charging stocks, including those from northern and central Texas, Louisiana, Oklahoma and Kansas as well as those from the Rocky Mountain, Appalachian and Indiana fields usually require from 2 to 6 lb. of acid per barrel of distillate. Those from Texas coastal, Smackover, California, Mexican, South American, Borneo, etc., charging stocks usually require 5 to 10 lb. of acid per barrel of distillate.

The principles outlined in the preceding methods may be applied to either batch or continuous treatment of the cracked distillate. From the viewpoint of economy in the cutting down of losses, continuous treating systems of the orifice, baffled coil or other mixing type should be used. Batch agitators, if already installed, may be equipped if desired with circulating devices, instead of air blowing.

The gasolines from certain types of treated cracked distillates may be treated with plumbite direct with good results, especially when blended with straight-run gasoline. This is not usual, however, and there is no advantage to be gained, as the above methods will also handle these types equally as well. In addition the usually harmful results of adding sulphur in this type of treatment is eliminated.

The general opinion regarding the purpose of plumbite treating is that this reagent removes certain sulphur compounds that render the gasoline unstable. Of the three general forms in which sulphur occurs in

crude petroleum or commercial products—namely, (*a*) free sulphur; (*b*) hydrogen sulphide; (*c*) organic sulphur compounds—hydrogen sulphide and some members of the last group react with a solution of litharge in sodium hydroxide.

With regard to the doctor test and its relation to stability and the presence of sulphur compounds, it has been the writer's experience that:

(*a*) Some types of cracked gasoline may contain as high as 1 per cent of combined sulphur; react positive to the doctor test (termed sour) and yet be stable and remain water-white over long periods to various conditions of exposure. Such gasolines when treated by method 2 or 3 may be rendered sweet by washing with plain caustic soda solution.

(*b*) Some cracked gasolines may be rendered sweet (react negative to the doctor test) by treatment, but upon exposure to sunlight and other conditions will cloud or go off color. Usually, however, when sweetened before distillation and distilled, the gasoline will remain stable, although some exceptions have been noted. A method of stabilizing the more refractory cases has been cited above.

(*c*) Some color-forming compounds of the diolefine and terpene type present in cracked gasoline will react positive to the doctor test. The test was made on practically sulphur-free materials from a cracked oil. Brooks and Parker (private communication) have shown that turpentine will react similarly.

Some interesting experiments in this connection with cracked distillates from Topped Panuco crude (Bé. gr. 9.7, sulphur 5.37 per cent) indicate that:

(*a*) Cracked gasoline from the untreated pressure distillate before and after plumbite treatment contained the same percentage of sulphur—namely, 0.85 per cent.

(*b*) Treating the cracked distillates according to 3-*A* with 7 lb. of acid per barrel of oil gave an average reduction in sulphur content of the gasoline to 0.78 per cent. Twelve pounds of acid per barrel of oil reduced the sulphur content to 0.33 per cent. The gasoline in both cases was water-white, stable and easily rendered sweet by treatment with a dilute solution of sodium hydroxide.

Although no appreciable sulphur removal was effected by the plumbite treatment of this particular type of gasoline, a decided reaction occurs. (Morrell & Egloff, *Refiner and Natural Gasoline Manufacturer*, vol. 2, No. 7, July, 1923.) A change in color and the formation of a lead compound soluble in the oil has been cited. Treating the original cracked distillate with plumbite solution produced a partly suspended brownish black precipitate that contained about 5 per cent of lead sulphide. This precipitate has been generally observed in plumbite-treating and is usually referred to as lead sulphide. It is for the purpose of "breaking" out this precipitate that flowers of sulphur is generally used. (No reagent was used to remove the above precipitate for analysis, since simple filtration sufficed.)

It is evident, therefore, that the plumbite solution owes its stabilizing action not simply to the removal of sulphur compounds but to the removal of other color forming compounds as well.

Precautions in Distilling

Aside from the principles involved in the efficient fractionation of a hydrocarbon mixture such as is represented by original cracked distillates, the chemical factor also enters into the redistillation of such distillates to produce stable gasoline. Chemical changes owing to long-continued heating at a relatively too high temperature may render the gasoline produced both sour and unstable. Partial remedies for these difficulties have been cited above—that is, caustic soda solution for sweetening and fullers earth for stabilization. To avoid these difficulties, however, the temperature factor is controlled by the introduction of steam, which, owing to its partial pressure, lowers the average boiling point of the mixture. Preferably the steam is introduced into the body of the oil to increase the evaporating surface as well as for other beneficial effects. The time factor is taken care of by continuous or semi-continuous distillation instead of batch distillation.

With a properly proportioned fractionating column of the packed, bubble or other acceptable type, a good separation of the gasoline may be effected. A good practice for semi-continuous distillation is to start with a one-quarter charge in the still, feeding the distillate through the tower, and finally distilling off any gasoline components left in the still without feeding. Some steam, the quantity depending on the type of oil to be distilled, the capacity desired within certain limits and the critical temperature of distillation, is fed into the still preferably into the body of the oil. In general a reduction of the temperature and time of heating consistent with capacity and efficient separation should be the aim in carrying out the distillation operation.

Deterioration of Brown Print and Blue Print Paper

In the April 24 issue of the *Paper Trade Journal*, T. D. Jarrell and F. P. Veitch, of the Bureau of Chemistry, U. S. Department of Agriculture, published a paper on "The Effect of Brown Print and Blue Print Sensitizing Materials on the Physical Properties of Paper." The effect of the commonly employed commercial brown print and blue print sensitizing materials used in this country on the folding endurance, bursting, tearing and dry and wet tensile strengths of the paper to which these materials had been applied was investigated. At intervals of 1 to 16 weeks after coating, samples were taken from the coated rolls, developed, washed and air dried. The physical tests were made on these samples.

It was found that coated brown print paper deteriorates rapidly before it is developed. In 2 weeks after coating the folding endurance of the coated and undeveloped brown print paper decreased 75 per cent, and 95 per cent in 16 weeks; the tearing strength decreased 30 per cent in 2 weeks and 55 per cent in 16 weeks; bursting strength decreased 20 per cent in 2 weeks and 30 per cent in 16 weeks; and dry tensile strength decreased 10 per cent in 2 weeks and 20 per cent in 16 weeks. On the other hand, in 2 weeks after coating the wet tensile strength increased 35 per cent and in 16 weeks the increase was 25 per cent. These figures are the general average of all samples and are calculated from the results obtained with the same papers uncoated.

After being exposed, developed and washed, little or no deterioration occurred in the brown print paper even after 14 weeks. It is concluded that in order to secure durability of the prints, brown print paper should be developed and washed within a week after it is coated.

It was found that paper coated with blue print sensitizing materials now generally used in this country can be kept at least 4 months without deterioration of the paper.

Chilean Nitrate and Organic Nitrogen in

The Fixed Nitrogen Problem

The Economic Phases of the Importation of Chilean Nitrate Are the Bases for the Price of the Nitrogenous Ingredients of Fertilizer—The Decreasing Importance of Organic Nitrogen Is Explained

By Harry A. Curtis

Special Agent, Bureau of Foreign and Domestic Commerce, and Professor of Chemical Engineering, Yale University

THIRTY years ago Chile supplied about 73 per cent of the world's total demand for inorganic nitrogen. Since then the production of nitrate in Chile has greatly increased, but the world's demand has grown so much faster that today Chile supplies less than 40 per cent of the total. The fact that nitrate has always moved into an expanding market has strongly influenced the condition of the industry in Chile. Under such environment it should not be expected that technical developments in methods of production would be pushed vigorously, for such developments are born of competition, actual or imminent, and do not come in a highly profitable enterprise free of any serious competition. It may be thought that since Chile's relative share of the world's trade in inorganic nitrogen has decreased to about 40 per cent of the total, Chilean nitrate long ago would have ceased to control the world's price for inorganic nitrogen. This view, however, would quite overlook the fact that most of the nitrogen that has gone into the market to swell the world's total consumption and thereby reduce the relative percentage of Chilean nitrate has been of byproduct origin, chiefly from the coke and coal gas industries. In the nature of things this byproduct nitrogen will be sold at a price that will insure its sale. If there were enough byproduct nitrogen produced, it would obviously shut out Chilean nitrate entirely, unless the price of nitrate were cut to a point where it would not pay to recover the byproduct at all, and there is no chance of this under present conditions. Once byproduct nitrogen is produced it will be sold; the remainder of the market goes to Chile. The price fixed for Chilean nitrate, therefore, is determined by the urgency of the world's need for the remainder of its requirements. This urgency is carefully scrutinized from year to year by various agents of those who control the nitrate industry in Chile, and year by year a price is set which, in their judgment, will result in the sale of a sufficiently large bulk of nitrate to insure profitable operation of the industry.

> Why is Chilean nitrate the dominating factor in the nitrogen situation when it occupies a subordinate position in respect to tonnage? Why is organic nitrogen in its many forms disappearing as a fertilizer ingredient? Authoritative answers to such economic questions as these and authoritative statistics and estimates on distribution have contributed to make this part of the Fixed Nitrogen report not only interesting but vital to industry. This article is the fourth and last of the series made up of excerpts from the report.

The parity between the prices of nitrogen in Chilean nitrate and in byproduct ammonium sulphate is striking. In Fig. 1 these prices are plotted for the years 1901 to 1923, average New York prices being used. (Data compiled by The Barrett Co.) It is of interest to note on the curve for nitrate nitrogen prices the reflection of the attempt made by the producers in 1919 and 1920 to stabilize nitrate prices at a point evidently considerably above the economic level.

Since the World War the United States has become the largest consumer of Chilean nitrate. In fact the United States bought during the last fiscal year more nitrate than went to all of Europe and nearly as much as Europe and Egypt combined. Table I shows the proportion of Chile's total nitrate shipments taken by the United States year by year since 1910. Incidentally the table shows the effect of the great slump of American agriculture in 1921 and its subsequent recovery.

In Table II the calendar year 1913 is compared with 1922 and 1923. It will be noted that both European and American consumption of nitrate in 1922 was still considerably below that of 1913. The 1923 figures are for the fiscal year ended June 30, 1923, and show the greatly increased consumption in the United States as compared with Europe.

The difficulty of showing allocation of the Chilean nitrate to agriculture and the various industries lies

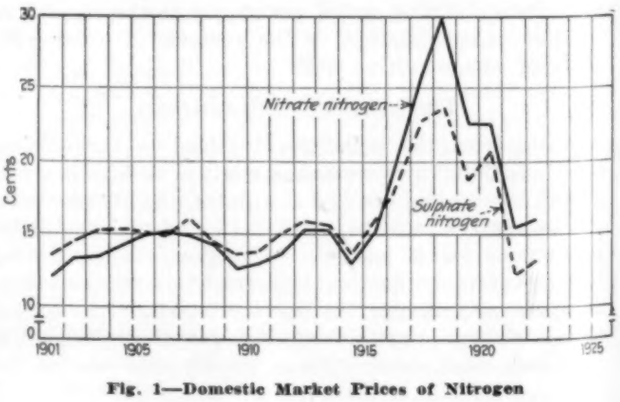


Fig. 1—Domestic Market Prices of Nitrogen

Table I—Chilean Exports of Nitrate to United States*

(Metric Tons)

Calendar Year	Chilean Export	Destined for Continental U. S.	Destined for Porto Rico and Hawaii	Total to U. S.	Per Cent to U. S.
1923†	2,101,044	926,898	46,640	973,538	46.3
1922	1,252,050	251,734	27,435	279,169	22.3
1921	1,193,062	108,297	22,877	131,174	10.9
1920	2,746,118	1,234,092	44,920	1,279,012	46.6
1919	803,753	294,874	.....	294,874	....
1918	2,960,089	1,962,553	.....	1,962,553	....
1917	2,797,872	1,593,826	1,670	1,595,496	....
1916	2,966,678	1,300,174	.....	1,300,174	....
1915	1,991,094	864,055	.....	864,055	....
1914	1,925,246	553,333	.....	553,333	....
1913	2,666,005	572,196	.....	572,196	21.5
1912	2,498,529	426,184	.....	426,184	....
1911	2,454,668	415,222	.....	415,222	....
1910	2,356,668	586,692	.....	586,692	24.9

* Official statistics of Chilean Government except for 1923.
† Fiscal year ended June 30, 1923. Data of Chilean Nitrate Producers Association.

Table II—Exportation of Chilean Nitrate to Various Countries*

(In metric tons. Calendar years 1913 and 1922.)

Country	Metric Tons 1913	1922	1923
Continent for orders	.....	543,854	568,771
Great Britain	†980,675	81,137	82,837
France	162,664	40,855	48,171
Holland	99,563	50,966	80,622
Spain	24,190	36,674	45,662
Egypt	40,227	43,719	61,397
Belgium	123,508	28,290	27,309
Italy	12,301	16,113	30,559
Norway and Sweden	.....	4,992	8,784
Denmark	.....	.....	9,106
Mediterranean ports	.....	.....	4,746
Germany	632,346	‡49,811	40,350
Total to Europe and Egypt	2,045,474	896,411	1,008,315
Per cent of total	76.7	71.6	48
South Africa	.....	8,392	28,516
Japan	31,887	56,237	77,707
Australia	.....	4,790	6,131
Canada	.....	391	1,168
Cuba	.....	2,147	4,572
All others	16,448	4,514	1,097
Total	48,335	76,470	119,191
Per cent of total	1.8	6.1	6
U. S. Continent		251,734	926,897
Hawaii	572,196	26,223	43,796
Porto Rico		1,212	2,844
Total to U. S.	572,196	279,169	973,538
Per cent of total	21.5	22.3	46
Grand total	2,666,003	1,252,050	2,101,044
Per cent of grand total	100	100	100

* Official satistics of the Chilean Government.
† Most of this reconsigned.
‡ For transshipment.

in the fact that the United States census returns discover only the nitrate that goes into manufacturing,

In Table III the census data are used, and the assumption is made that there were no large changes in stocks of nitrate carried forward from year to year, except in those of the War Department, and that all Chilean nitrate not accounted for by the census was used directly as agricultural fertilizer.

In this table one is struck by the large amount of nitrate that is apparently used directly as a fertilizer. The percentages of the total going into agriculture, however, line up with the estimates made by certain nitrate importing firms. A little further light is thrown on this point by the fact that in 1919 the U. S. Department of Agriculture distributed 153,000 tons of nitrate

Table IV—Nitric Acid Manufactured in the United States*

(Net tons of 2,000 lb. each)

	1909	1914	1919	1921
Establishments	25	52	59	56
Made and consumed	55,054	63,904	67,556	49,587
For sale	13,663	14,685	19,436	8,300
Total	68,717	78,589	86,992	57,887
Chilean nitrate required, assuming 1.4 tons nitrate per ton of acid	86,204	110,025	121,789	81,042

* Bureau of Census data for nitric acid manufacture.

Table V—Uses of Nitric Acid in United States

(In net tons of 2,000 lb. each)

Industries	1919 Acid	1919 Nitrate Equivalent	1921 Acid	1921 Nitrate Equivalent
Sulphuric, nitric and mixed, mixed acid industry	18,831	26,364	10,213	14,298
Chemicals industry	18,962	26,547	13,271	18,579
Explosives industry	48,588	68,023	34,376	48,127
Other industries	611	855	27	38
Totals	86,992	121,789	57,887	81,042

for direct application in addition to what was sold by other agencies for direct application.

The quantities of nitrate used for manufacture of nitric acid may be estimated from the Bureau of Census data, as indicated in Table IV. The allocation of this acid and the equivalent nitrate to the various industries is given in Table V.

Nitrogen From Animal and Vegetable Sources

It is most difficult to arrive at satisfactory estimates for the amount of fixed nitrogen recovered from animal and vegetable waste materials and returned to the soil as fertilizers. Of the total fixed nitrogen contained in food materials consumed by domestic animals, less than 50 per cent, and probably not much more than 25 per cent, ever finds its way back to the soil. In the natural course of events the remainder is ultimately returned to the air as ammonia or free nitrogen and so lost from our useful supply. Of the fixed nitrogen in human foodstuffs, practically none gets back to the soil, our methods of sewage disposal being such that this fixed nitrogen is lost and eventually returned to the air through natural processes of bacterial and chemical action. We do, however, gather up a considerable variety of animal and vegetable waste products, and return them to the soil through the medium of mixed fertilizer. It must be recognized, of course, that the net result of this is only to increase slightly the percentage of fixed nitrogen returned to the soil, as a small offset to the enormous amounts removed by crops. Nevertheless, since every pound of fixed nitrogen returned to the soil in such way represents one less pound to be secured from some other source, it is proper to include the nitrogenous materials so conserved in our consideration of fixed nitrogen supply.

Of the total fixed nitrogen content of all mixed fer-

Table III—Consumption of Chilean Nitrate in the United States

(Net tons of 2,000 lb. each.)

Calendar Year	Total Imports (a)	From Other Sources	In Mixed Fertilizers (b)	In Acid for Fertilizer Manufacture (b)	In Manufacture of Explosives (b)	In Chem. Industries (b)	Miscellaneous (b)	Balance, Assumed Used Directly as Fertilizer (c)	Per Cent to Agriculture	Per Cent to Industry
1914	606,720	.....	147,050	15,134	190,960	58,101	1,503	193,972	58.7	41.3
1919	456,354	238,833 (d)	130,683	21,732	174,742	78,810	12,404	276,816	61.7	38.3
1921	413,474	90,720 (e)	Census for 1921 did not include data for distribution							

(a) Bureau of Foreign and Domestic Commerce.
(b) Bureau of the Census.
(c) Remainder not accounted for by census, assumed to be used directly as fertilizer.
(d) Sold by War Department, 114,260 tons; transferred from War Department to Agricultural Department for distribution, 124,573 tons.
(e) Sold by War Department.

tilizer sold in this country in the years 1912 to 1917, inclusive, roughly 57 per cent was derived from animal and vegetable materials, according to H. S. Washburn, of the American Cyanamid Co. (Hearings, Committee on Agriculture and Forestry, S. 3,390, 66th Congress). Cottonseed meal and tankage were the chief of these, but smaller amounts of dried blood, fish scrap, bone meal, hide and leather scrap, hair, horn and hoof meal, guano, castor pomace, etc., are included; in fact almost any nitrogenous material for which there is no other sale finds use in the fertilizer industry. In recent years there has been a tendency to replace more of this organic nitrogen in mixed fertilizers by fixed nitrogen in the form of ammonium sulphate, Chilean nitrate, etc., due primarily to the fact that such materials as cottonseed meal, tankage and fish scrap are proving of more value as stock feed than as fertilizer. It is to be noted that these materials are all low in nitrogen content as compared with ammonium sulphate. On the other hand, they are highly concentrated stock foods, and should logically be used as such. It is argued that, used as fertilizer, they not only add nitrogen to the soil, but also add organic matter that is highly important in establishing favorable bacteriological conditions in the soil. There are, however, other and cheaper methods of adding organic matter to the soil. The chief advantage in using these so-called "organic ammoniates" appears to be that they do serve to "condition" a mixed fertilizer—that is, to improve its suitability for handling, particularly for drilling. The prices they command as stock feed will automatically reduce their use as fertilizers, but it is safe to assume that there will always be a considerable tonnage of nitrogenous scrap of various sorts going into mixed fertilizer, particularly such as do not find a ready market at higher prices. In Table VI there is shown the approximate quantities of the various nitrogenous materials which, according to Washburn, were used as fertilizer on the average for the 6 years 1912-17 inclusive.

There has no doubt been a considerable change in the situation since Washburn made his compilation. For example, Washburn shows 800,000 tons per year of cottonseed meal used for fertilizer. The estimates of Table VII for the cottonseed meal going as fertilizer at present were made by B. F. Taylor, general fertilizer manager of the Southern Cotton Oil Co.

On the basis of the foregoing estimate, which is probably the best to be had, about 10 per cent of the cottonseed meal produced in the South is now going into fertilizer, the remainder into stock feed. The tonnage going into fertilizer is only about 150,500 tons at present, compared with the 800,000 tons which Washburn estimates as the average for the years 1912-17.

Again, Washburn estimates an annual use of 240,000 tons of tankage. Today practically the only tankage going into fertilizer is renderer's tankage and an occasional parcel of packer's tankage not fit for use as stock feed. Probably less than 10 per cent of all the animal tankage produced in the United States now goes into fertilizer, and the total is only a small fraction of the figure used by Washburn. In considering the fixed nitrogen available from vegetable sources, we must not forget that, so far as agriculture is concerned, enormous amounts in aggregate are supplied to the soil through bacterial action and through rainfall. Were it not for this fact, the proposition of supplying nitrogen to the soil through commercial fertilizers would be rather hopeless.

As shown in a previous chapter, rainfall carries down a few pounds of nitrogen per acre in the course of a year, and multiplying these few pounds by 365 million, representing acres of cultivated land in the United States, gives a figure beside which our total nitrogen in commercial fertilizers appears insignificant. And it appears still more insignificant when compared with the nitrogen taken from the air and fixed in the soil by bacterial action. Bacteria form the natural link between the free nitrogen of the air and the fixed nitrogen which plays so important a rôle in animal and vegetable life. The perpetual succession of processes by which the nitrogen of the air is assimilated and transformed by bacteria in the soil, taken up by plants and through plants by animals, to be returned again to the soil, or eventually to the air as free nitrogen, forms a natural cycle of events involving quantities of nitrogen beyond comparison with those which are or may ever be handled by human agencies.

Such considerations, however, lead to no immediate practical results, but in viewing the nitrogen problem in its larger aspects, the possibility should not be overlooked that the necessary supply of fixed nitrogen in the soil may at some future time be secured by gaining control over the natural bacterial processes in the soil by which nitrogen is fixed. Research along this line has not been lacking, but progress has been slow. The growing of legumes is but a short step toward the goal. Meanwhile direct chemical processes of nitrogen fixation have developed and will presently be able to supply fixed nitrogen cheap enough to be a factor in agriculture.

Table VI—Nitrogenous Materials Used in Fertilizers*

(Average of years 1912 to 1917, inclusive. In short tons of 2,000 lb. each.)

Material	Material	Fixed Nitrogen	Per Cent of Total Nitrogen
norganic:			
Nitrate of soda	225,000	35,000	21.4
Sulphate of ammonia	135,000	28,000	17.1
Cyanamide	25,000	4,600	2.8
Total	385,000	67,600	41.3
Organic:			
Cottonseed meal:			
Outside fertilizer industry	500,000	29,000	17.8
Inside fertilizer industry	300,000	18,000	11.0
Tankage	240,000	18,700	11.5
Dried blood	27,000	3,000	1.8
Fish scrap	44,000	2,700	1.7
Garbage tankage	110,000	3,100	1.9
Guano	60,000	3,900	2.4
Castor pomace	28,000	1,600	1.0
Leather scrap	16,000	1,700	1.0
Hair and wool waste	10,000	1,300	.8
Hoof meal	6,000	400	.3
Base goods, miscellaneous	555,000	12,300	7.5
Totals	1,896,000	95,700	58.7
Grand totals	2,281,000	163,300	100.00

* H. S. Washburn, Hearings, Committee on Agriculture and Forestry, S3390, 66th Congress.

Table VII—Cottonseed Meal Used as Fertilizer

(Period Aug. 1, 1922 to Aug. 1, 1923, in net tons of 2,000 lb. each)

State	Production at Cotton Oil Mills	Used as Fertilizer
Alabama	94,158	18,830
Georgia	122,638	24,500
So. Carolina	70,628	47,098
No. Carolina	130,651	26,000
Mississippi	169,360	9,000
Louisiana	47,188	2,000
Tennessee	124,057	4,000
Arkansas	115,241	5,000
Oklahoma	88,137	8,000
Texas	455,016	5,000
All others	63,701	None
Total	1,480,775	149,458

How Plant Conditions Influence the Choice of Refrigerating Machines

A Discussion of Some of the Factors That Govern the Decision as to Refrigeration Systems in Industrial Plants

By H. J. Macintire
Associate Professor of Refrigeration, University of Illinois

IN considering refrigeration, the engineer or plant manager is often at a loss whether to select a compressor or an absorption machine; and, if the compressor be selected, whether the refrigerant should be ammonia or carbon dioxide, or something else. And yet this an important consideration, and one worthy of much thought if the most economical plant is to be obtained.

Plant conditions usually enable one to make a certain preliminary decision. For example, if low temperatures must be obtained, —10 deg. F. or lower, it is necessary to use stage ammonia compression or the absorption machine, with a possibility of using the CO_2 compression system in certain cases. Where exhaust steam is plentiful, it may be that the absorption machine is the only one that can be used to advantage; but in some cases ammonia is barred out for process reasons and, unless brine circulation is permitted, there remains only the CO_2 machines from among the usual types. As stage ammonia compression has been developed for some time, its advantages are well known, and they prove it no longer necessary to use the absorption system in order to secure low temperatures economically.

In some plants it is necessary to provide several refrigerating temperatures at a given time. When such conditions occur, it is usual to operate separate machines on the different loads, or to operate the head end and the crank end of a double acting compressor at different suction pressures. Another method is to use the so-called "multiple effect" compression, by means of which the compressor draws into the same cylinder gas at two different pressures. The particular advantage of the scheme, which has been tried in only a few places in this country, is that there is some increase in efficiency of compression and that there is the friction of only one machine to overcome instead of two.

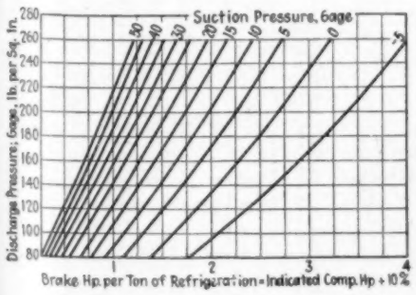


Fig. 1—Horsepower Per Ton of Refrigeration for Ammonia

REFRIGERATION

In the Sept. 10, 1923, issue of *Chem. & Met.* an article by Seymour A. Woolner covered the general groundwork necessary for an elementary knowledge of the refrigeration systems and their use. This unit process, an understanding of which becomes increasingly important to the chemical engineer, is again discussed in the accompanying article. In it the author points out some of the governing factors in industrial plants that influence the engineer to choose one refrigerating system rather than another. In future articles, a more detailed discussion of the industrial application of refrigerating systems will be undertaken.

A UNIT PROCESS OF CHEMICAL ENGINEERING

Recent Design Changes

Compressors for refrigeration are tending to a definite change in design. Whereas some years ago compressors seldom had a speed in excess of 100 r.p.m., now, at least in the smaller sizes, speeds are more likely to be 150 to 200 r.p.m., or even greater. One recent American design for a reciprocating compressor uses speeds varying from 600 to 1,200 r.p.m., the reciprocating parts being similar to those used in automobile construction. The tendency to higher compressor speeds has been enhanced by the popularity of lightweight suction and discharge valves, by the increased use of direct motor drive and by the improvement in the design of lubrication systems.

To these factors may be added the influence of improved compressor design and construction and the fact that a more homogeneous metal is now being used—heat-treated to prevent trouble from shrinkage strains developed in the sand after casting. The tendency in ammonia compressors is to change from cast-iron to semi-steel cylinders; and (in sizes up to 75 tons) to use the inclosed type of single acting vertical compressor, usually twin-cylindered in the United States and having three or more cylinders in Great Britain. This type of machine has generally used splash lubrication in the crankcase; but the later designs show a positive oil feed from a power pump (usually connected to the shaft of the compressor) to the different pins and bearings requiring lubrication. The larger-sized compressors may be single-action, vertical machines of the semi-open type or may be double-acting horizontal machines; but in either case the design is being affected by a desire to increase the speed in order to use a direct-connected motor which will not be as expensive as slow speed motors always are.

Present-day valve design differs radically from that of a few years ago. The "poppet" design is now almost obsolete. This valve was good, in that it could be made tight and was easily ground to a seat. It is, however, heavy, expensive to make and does not lend itself readily to use with speeds much over 75 r.p.m. To increase the net area of the valve opening and also to get a valve of slight inertia, valves of the "plate," "ring-plate" and "ribbon" types have been designed. These valves are secured in suitable cages. They may be seated by

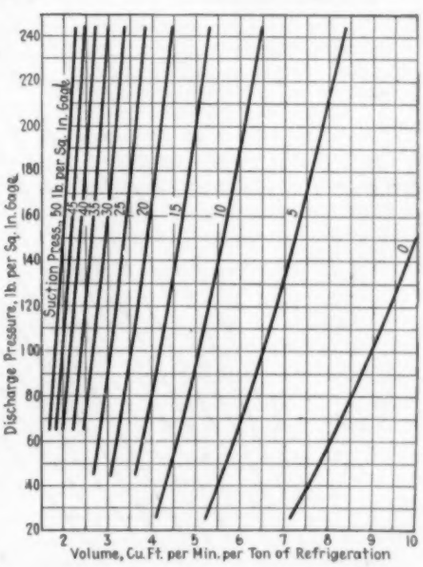


Fig. 2—Volume of Ammonia in Cu.Ft. Per Ton of Refrigeration (No Liquid Cooling)

means of springs, or, in the case of the ribbon valve, be tempered until they have enough spring to seat themselves. One British design of "ring-plate" type is designed so that the valve rotates through a small angle each time it operates. This gives a grinding action on the seat and also tends to wipe away foreign matter. With this design a gas velocity of 1,800 ft. per minute is permitted in the suction and discharge ports and valve passages.

Effect of Design on Operation

The effect of valve design on economy of operation can be shown by a problem and by Figs. 2 and 3: If a compressor is designed to give a ton of refrigeration at 15 lb. suction and 160 lb. condenser pressure, it will require, according to the chart, 1.42 hp. and the piston displacement per ton refrigeration will be 4.7 cu.ft. per minute. If wire-drawing should reduce the suction pressure to 10 lb. (to take an extreme case), the horsepower required would be 1.62, or an increase of 14.1 per cent. The piston displacement per ton refrigeration will be increased to 5.7 cu.ft. per minute, and the tonnage, assuming a constant speed of the compressor, will be 4.7 ÷ 5.7 = 0.826.

It will be seen from the horsepower chart that the power required to drive the compressor and the capacity of the compressor are dependent on operating conditions. The condenser pressure affects the horsepower per ton of refrigeration, as does also the suction pressure, and the tonnage capacity of the machine is also affected by both. The result is that the coldest available condensing water should be used to shower the condenser, for the condenser pressure is very nearly the pressure corresponding to the exit condenser water temperature. It is also evident that the machine should be operated at as high a suction pressure as the conditions of the plant permit. All of the foregoing is evident from a study of Figs. 1 and 2.

The two-stage compressor has made a decided advance in favor during the past 2 or 3 years. It gives a more economical operation in horsepower per ton of refrigeration than does single compression. The volumetric efficiency is greater and therefore the tonnage per cubic foot of piston displacement is greater, comparing the low-pressure cylinder with the single-stage compressor. There is less trouble due to high gas temperature on discharge from the cylinder. And finally, the working conditions are better with regard to torque on the shaft.

For example, considering 20 lb. gage suction pressure and 175 lb. gage condenser pressure as giving unit capacity, the capacity of the simple compressor would be:

1.611 tons of refrigeration at 40 lb. gage suction.
1.306 tons of refrigeration at 30 lb. gage suction.
1.00 ton of refrigeration at 20 lb. gage suction.
0.699 ton of refrigeration at 10 lb. gage suction.
0.410 ton of refrigeration at 0 lb. gage suction.
0.263 ton of refrigeration at —5 lb. gage suction.

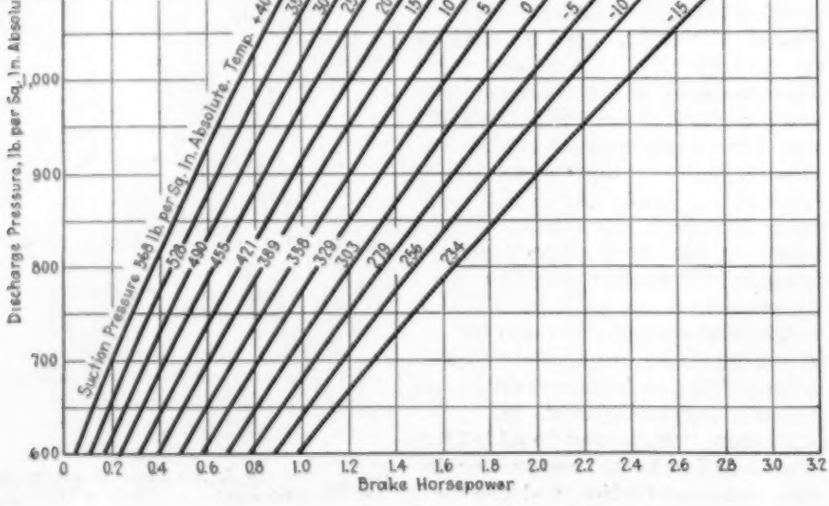


Fig. 3—Horsepower Per Ton of Refrigeration for CO_2

Table I

Heat removed in absorber, for values of strong and weak aqua, under a range in temperature conditions. The pressure in the absorber is that corresponding to the temperature and concentration of the strong aqua. It is assumed that the ammonia gas enters the absorber dry and saturated.

Per Cent Weak Aqua		Temperature and Concentration of Strong Aqua — 25% — 60 Deg. F.				80 Deg. F.				100 Deg. F.				30% — 60 Deg. F.				80 Deg. F.				100 Deg. F.				35% — 60 Deg. F.				80 Deg. F.				100 Deg. F.				40% — 60 Deg. F.				80 Deg. F.				100 Deg. F.			
		Temp. Weak Aqua																																											
		80	100	120	140	100	120	140	160	120	140	160		80	100	120	140	100	120	140	160	120	140	160		80	100	120	140	100	120	140	160	120	140	160		80	100	120	140	100	120	140	160	120	140	160	
10	G	5	5	5	5									4½	4½	4½	4½	4½	4½	4½	4½	4½	4½	4½		4.0	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4	4	4	4	4	
	B.t.u.	853	954	1056	821	924	1026							889	979	783	873	963	766	856	948					769	852	936	752	836	920	735	819	905				732	812	892	720	800	880	704	784	864			
15	G	7½	7½	7½	7½	7½	7½							6½	6½	6½	6½	6½	6½	6½	6½					6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	
	B.t.u.	892	1046	1200	862	1016	1173							829	1007	1153	848	993	1139	831	976	1125	799	1087	798	934	1074	769	922	1047	779	906	1033	762	890	1020	732	812	892	720	800	880	704	784	864	688	768	848
20	G	15	15	15	15	15	15							14	14	14	14	14	14	14	14	14	14	14		13	13	13	13	13	13	13	13	13	13	13		12	12	12	12	12	12	12	12	12	12	12	
	B.t.u.	1035	1344	1656	1021	1332	1644	1006	1318	1636				995	1286	1579	980	1274	1568	965	1258	1559	952	1224	1499	937	1211	1487	921	1197	1480	907	1160	1416	891	1146	1404	876	1132	1397	861	1118	1374	846	1104	1362	832	1090	1348
25	G																																														
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G = Weight of weak aqua circulated per 1 lb. of ammonia gas absorbed in absorber.

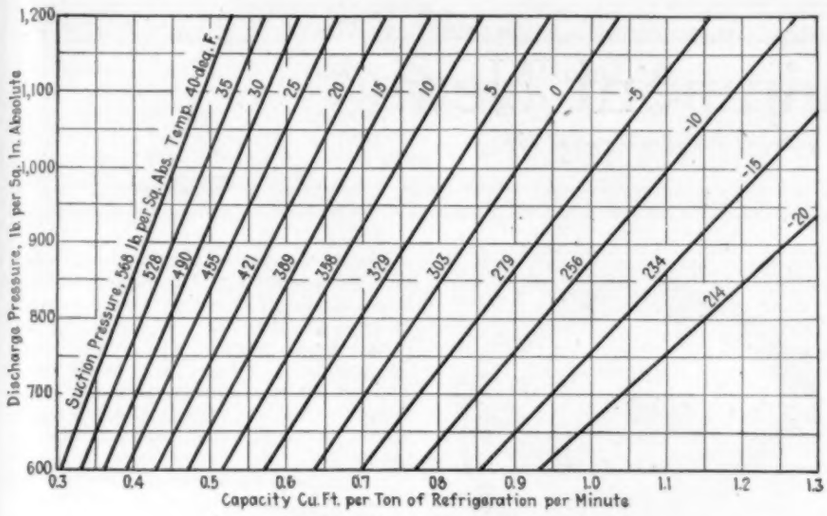


Fig. 4—Capacity of CO_2 Compressors

The horsepower per ton of refrigeration would, at the same points (see Fig. 1), be 0.92, 1.12, 1.37, 1.80, 2.42 and 3.10. The gain by the use of the stage-compound compressor is roughly from 10 to 15 per cent and the gain in the capacity of the low-pressure cylinder would be much greater, varying with the pressure range of the low-pressure cylinder.

A theoretical calculation for conditions of 1.25 lb. gage suction pressure and 115 lb. gage condenser pressure gives the horsepower per ton of refrigeration as 1.57 for single compression and about 1.25 using stage compression, this latter value varying slightly with the various details of cooling between the stages. In addition, if single-stage compression were used, the temperature of the discharge gas would be too high, from 225 to 250 deg. F., and wet compression would be resorted to by the operating engineer — that is, liquid ammonia would be sprayed into the suction of the compressor in order to reduce the discharge temperature. Wet compression causes reduced efficiency, so that the difference noted above would be increased. The volumetric efficiency of the low-pressure cylinder would be 90 per cent for the two-stage compressor, while that of the simple compressor is about 81 per cent, so that the low-pressure cylinder of the two-stage compressor could be smaller in that proportion. Thus when low suction pressures are used, the apparent volumetric efficiency is decreased; but the gain is because of the reduced temperature range of the cylinder and the corresponding reduction in the superheating effect of the cylinder walls.

The absorption system is in a sphere by itself. Its action depends on the ability of water to absorb ammonia gas in amounts depending on several factors, increasing greatly with reduced temperature and to a less degree with pressure. In consequence, a solution of cool, weak ammonia and water in the absorber has the ability of absorbing additional gas and thereby becoming a stronger solution. On heating this stronger liquor in the generator, the gas previously absorbed is driven out of solution, under the pressure of the condenser, where it is subsequently condensed by a cooling shower.

Considerable care must be exercised if good results are to be obtained with this system. The difference in concentrations of the strong and weak solutions is extremely important, for it determines the amount which must be circulated through the absorber and on to the generator so as to carry the requisite amount of ammonia gas.

But each pound of liquid circulated requires a certain amount of heat in the generator and water in the absorber, which makes economical results depend on having a difference in concentration of 6 to 12 per cent by weight. Table I shows this clearly, the number of B.t.u. being the heat required to be absorbed by the water per pound of ammonia gas absorbed. A similar table would show the steam used in the generator, which varies from 30 to 50 lb. per ton of refrigeration per hour. The water requirement of the absorber varies in like proportion.

From the foregoing, it is clear that the engineer, to make an intelligent choice of a refrigerating system, must investigate the conditions of operation. When the best type of machine has been selected for the particular conditions of the plant, it is necessary, if its efficiency and full capacity operation are to be maintained, to watch the conduct of the plant with great care. The condenser pressure must be kept as low as possible, and the suction pressure as high as possible. It goes without saying that the physical condition of the plant must be good, the valves and piston rings tight, the condenser free from oil and scale and the low-pressure side free from ice and impurities.

Finding Maximum Combustion Temperatures

Certain chemical reactions that are associated with high temperatures possess great technical importance. Those that are especially interesting to the engineer are the combustion reactions, such as occur in boiler practice, in the internal combustion engine, in the gas producer and in the oxy-hydrogen and oxy-acetylene flame.

Reactions at high temperatures present certain phenomena that have not received a great deal of attention from engineers. It is not always recognized that the reaction energy —that is, the available work of the reaction—is not generally the exact equivalent of the heat of reaction. Again, at high temperatures a reaction cannot proceed to completion, but must halt when the constituents attain a state of equilibrium. The maximum temperature that can be attained is thus definitely limited by the law of chemical equilibrium.

The equilibrium conditions for a chemical reaction have been determined from the laws of thermodynamics, and for the principal dissociation reactions, as $CO_2 = CO + \frac{1}{2}O_2$ and $H_2O = H_2 + \frac{1}{2}O_2$, these conditions are furnished by equilibrium equations which can be established with a fair degree of accuracy. These equilibrium equations, along with an equation connecting the heat of combustion with various energy changes, furnish a system from which the temperature attained at equilibrium may be calculated directly.

It is the purpose of Bulletin 139, issued by the Engineering Experiment Station, University of Illinois, to investigate the conditions of equilibrium, to establish the necessary equilibrium equations and to incorporate these equations into a formulation by means of which the maximum temperature resulting from the combustion of a fuel under predetermined conditions may be calculated.

Equipment News

From Maker and User

Indicating Thermometer of Simplified Construction

Industrial Thermometer Users Will Be Interested in Design Which Permits a Lower Price

A new indicating thermometer of the dial type has recently been placed on the market by the Moto Meter Co., Inc., Long Island City, N. Y. This instrument is called the "Motoco Industrial Thermometer."

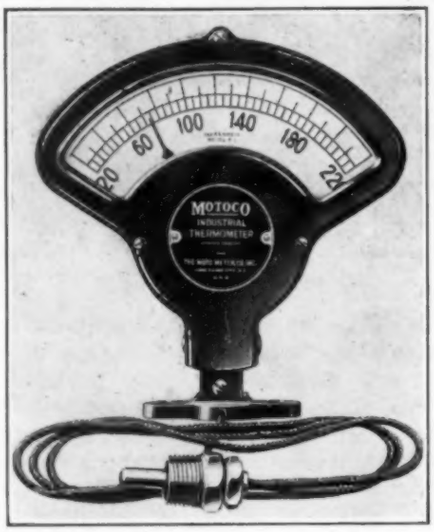
The construction of the device has been simplified so that it can be marketed on a competitive basis with high-grade armored glass thermometers. The pointer is connected directly to the Bourdon coil, making a "one to one" movement, thus eliminating the usual intermediate rack and pinion movement and all incidental screws, levers, gears, hair-springs and other delicate parts. The arbor on which the pointer is mounted rotates on a bearing and is the only movable part. The pointer is riveted to this arbor, thus eliminating any possibility of its working loose.

The thermometer bulb, the flexible tube leading from it and the Bourdon coil are filled with specially treated alcohol under pressure. This alcohol causes the coil to wind or unwind as the temperature changes and, in so doing, moves the pointer across the dial. The tubing used is Schlaich's star-shaped tubing. This is formed by running the tubing through V-shaped rollers, which pushes the walls inwardly to form a tube of star-shaped section, with a diameter between 0.006 and 0.007 in., about one-third that of ordinary tubing.

A temperature-compensating device is attached to the Bourdon coil to correct for temperature surrounding the dial and tube and give a true bulb reading. The bulb itself is made small, 2 in. long by ¼ in. diameter, so that it may be used in a 1-in. pipe.

The bracket is constructed so that the thermometer may be mounted on either vertical or horizontal surfaces. The dial can be swung on the bracket so that it can be inclined to an angle sufficient to bring it into view when the setting is high or otherwise inconvenient.

Non-ferrous metals are used throughout in the construction of this thermometer, to protect it from the action of dampness, gases, fumes, etc. The case and bracket are of aluminum. The F-1, or large size, weighs 1½ lb. with tubing, while the small size, F-2, weighs 1 lb. Standard equipment consists of 10 ft. of tubing or 12-in. rigid stem for direct mounting. It can also be fitted with electric contacts for bell ringing. The extreme diameter of the dial face, type F-1, is 6½ in. This instrument is made in eleven dial ranges, from minus 40 deg. F. to 500 deg. F. Type F-2 measures 5 in. across the dial face and comes in nine ranges of the same temperature latitude as the F-1.



Dial Thermometer of Novel Type

The Motoco industrial thermometer is constructed on the same principles as the airplane moto-meters manufactured by this company during the war, and is made of the same materials as approved by the U. S. Bureau of Standards. More than 20,000 instruments of this type were used during the war on army and navy planes, including the famous NC transatlantic fliers.

Thermostatic Control Meters for Measuring Liquids

The change in volume in gasoline for each 10 deg. F. is about 0.7 per cent, or about 1.3 per cent for each 10 deg. C. change. The expansive effect of temperature on all liquids is such that special attention must be paid to the type of device used for the measurement of volume. The American Liquid Meter Co., of Portland, Ore., manufactures an ingenious and efficient type of instrument, known as the Bassler volume meter, that is finding wide application in industrial plants and wherever accurate liquid measurement is essential. For example, the Portland Vegetable Oil Mills, manufacturing coconut oil from copra, keeps an accurate record of production of oil against the amount of oil in the incoming raw material. The temperature range of the oil during processing varies between 80 and 200 deg. F. In this plant the production and control records are based on the readings of Bassler meters, which measure and register the volume of oil, regardless of pressure, rate of flow, viscosity or temperature.

The meters are of the single-cylinder, positive-measuring displacement type. Each stroke of the piston discharges a definite quantity, the stroke being adjusted by a manual trip control until the predetermined discharge is obtained. The principle of measurement is positive, as distinct from the flow-type meter, in which the measurement is inferential. A thermostatic trip cylinder is charged with liquid having the same coefficient of expansion as that to be measured, and directly governs the piston displacement. This provision compensates for volume changes due to temperature variations.

These meters are manufactured to connect with the following sizes of pipe: 1½, 2, 3, 4, 6 and 8 in., with capacities ranging from 1,800 gal. to 2,400 bbl. per hour. The selection of the correct type of meter for specific purposes depends on the maximum and minimum temperature of the liquid, the maximum and minimum line pressure, the maximum and minimum rate of flow, and the gravity of the liquid. These data should accompany inquiries regarding the applicability of Bassler meters for special purposes.

Combined Recorder-Controller for Temperature

The C. J. Tagliabue Manufacturing Co., Brooklyn, N. Y., has added to its instrument line a combined recorder-controller. In this design an air-operated temperature controller mechanism and a recording thermometer are mounted in the same case and are actuated by the same thermostatic system. All the structural features of the "Tag" recorder such as the uniformly graduated chart, non-corrodible inverted fountain pen, pen pressure and position adjustment, and improved chart holder are incorporated in this design. One advantage claimed is the entire elimination of the rubber connections usually employed in instruments of the combined form.

Liquid Oxygen Container

Due to the recent increase in the use of liquid oxygen and other liquefied gases, the demand for containers for this class of product has rapidly grown. With this in mind, the Purox Co., of Denver, Colo., has designed and is now marketing such a container. It is made in 15, 25 and 50 liter sizes. It consists of two concentric metal spheres between which a high vacuum is maintained in the Dewar principle. The spheres are incased in and supported by a metal housing, which protects them from injury.

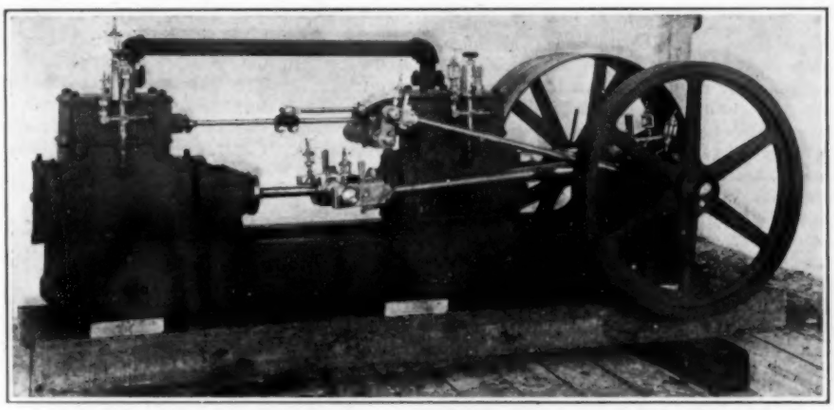
The neck, or spout, is of small diameter but of unique construction and

permits the liquid to be poured out by merely tilting the container. Pouring is accomplished without moving the spheres relative to each other, so that the container shows a minimum of liquid loss. Loss of oxygen by evaporation from these containers is a little less than 7 per cent per 24 hours.

The use of special metals is required, and extreme care must be taken in the treatment of these metals and their fabrication. It is the manufacturer's experience that these containers exhibit, in durability and economy of liquid, a marked advance over other available types. All containers sold will be repaired and kept in condition free for a year and after that at a reasonable charge.

Vacuum Pumps for Industrial Plants

An improved design of dry vacuum pumps for use with vacuum pans, evaporators, vacuum drying systems, receivers and other similar types of industrial equipment has recently been placed on the market by Guild & Garrison, Brooklyn, N. Y.



Two-Stage Belt-Driven Vacuum Pump

The pumps are of two styles, slide air valve, single type, and two-stage type. The single type is driven from a steam cylinder direct and the two-stage type is driven by either steam cylinder or belt. The air cylinder is run with ordinary oil lubrication after the manner of a steam engine and the slide air valve is mechanically moved. If preferred, this valve can be made of the rotative type with air valve chest on top of the cylinder.

Both sides of the air piston and inside of the cylinder heads are accurately faced, which permits close running and eliminates much of the loss ordinarily encountered in air cylinders. The action of the slide valve permits the undischarged air or gases to pass over and expand into the large area behind the piston when the latter is at the end of its stroke. On test, the pump shows an efficiency of approximately 98 per cent. Many advantages of construction and operation are claimed for these pumps by the makers, details of which they will gladly supply. Arrangements can be made for silent chain or motor drive. Capacity ranges from 27 cu.ft. per minute to 3,000 cu.ft. per minute in convenient sizes, according to the user's requirements.

Tests on Flowmeter Show Great Accuracy

Results Obtained at Farr Alpaca Co., Holyoke, Mass., Indicate Close Check With Actual Flow

By J. F. Cunningham
Flow Meter and Regulator Engineering Department, General Electric Co.

For many years flow nozzles have been used as a differential pressure-producing element in measuring the flow of gases and fluids. The theoretical and actual accuracy of this device is well known and yet at no time has an opportunity presented itself to carry on as interesting a test as that which was recently made by the Holyoke Power Co., of Holyoke, Mass.

Especially considering the fact that the flow was very large (approximately 30 tons of water per minute through a 24-in. pipe) the results were much more satisfactory than was anticipated or expected.

The General Electric Co. co-operated with the Holyoke Power Co., and a G-E indicating, recording and registering flow meter was used in the test.

Full directions for the installation of the nozzle and metering equipment were furnished to the Farr Alpaca Co., but by the time the concern installing the piping for the Holyoke Power Co. was ready to proceed, the instructions were either not in their complete original form or the pipers thought it was unnecessary to follow the instructions in detail. At any rate, the writer found the meter installed above the available head and an extremely short run (approximately 1½ pipe diameters) ahead of the flow nozzle. Before running the tests the nozzle was located at a point in the main with approximately 12 ft. of pipe preceding and a like length following the flow nozzle. The meter was placed below the available head, approximately 5 ft. above the flow nozzle. Water was admitted into the pipe from a large basin wherein a nearly constant head could be maintained by admitting a slightly larger amount of water than that passing through the pipe, and spilling the excess over an overflow through another drain. The water that passed the meter then flowed into another basin sufficiently large to eliminate agitations at the point of installation of a weir.

The meter readings were checked against the weir readings with results as follows:

At approximately one-fourth scale the weir and meter readings checked within 3 per cent. At about one-third scale the meter and weir readings checked within 0.5 of 1 per cent. At approximately three-fifths of full scale weir and meter readings checked within 0.2 of 1 per cent. At three-fourths scale the weir and meter readings checked within 0.5 of 1 per cent. At practically full scale, in spite of the variation in flow, due to the difficulty in maintaining a constant head with this enormous volume of water, meter and weir readings checked within 0.9 of 1 per cent.

The Holyoke Power Co. had its own staff of engineers to make these checks and the writer did not make any adjustments to the meter after the tests were once started. He did, however, find it necessary to eliminate the air that had collected in the meter piping before each point. This, of course, would have been unnecessary in a permanent installation. In this particular installation the meter was above the pipe and the flow was increased for the various points by enlarging a hole at the outlet, a 24-in. valve not being available. It was therefore necessary to drain the pipe completely between points and displace the consequent air accumulation in the meter pipes before each point.

Although every courtesy and absolute co-operation were extended by officials of the Holyoke Power Co. and their attitude could not be construed as in any way sceptical, I have no doubt that the results obtained far exceeded their fondest expectations. Their increasing enthusiasm, as the tests proceeded, was evinced by their questioning one of my ¾ of 1 per cent discrepancies, claiming an absolute check. I conceded ¼ of 1 per cent. This statement is not intended merely to lend a humorous angle to the tests but shows that no attempt was made on the part of the writer to shade readings in the right direction. In fact, they proposed later to make a leakage test on the basin with the idea that possibly there was a greater leak, due to the raising and lowering of the water in the basin, after the test than before starting. Any slightly greater leak would only tend to lessen the extremely slight discrepancies obtained.

Although the writer has on innumerable occasions obtained equally accurate results on many other tests, most of the tests were conducted using special test meters and on more generally employed sizes of pipe.

Manufacturers' Latest Publications

Firth-Sterling Steel Co., McKeesport, Pa.—A very complete and interesting illustrated book of 60 pages on the properties and uses of stainless steels.

Gifford-Wood Co., Hudson, N. Y.—A new illustrated folder on Gifford-Wood stationary and portable conveying machinery.

Steere Engineering Co., Detroit, Mich.—Pamphlet 232. A pamphlet on scrubber grids briefly describing material of this type made for use in condensing or scrubbing towers in gas plants.

York Mfg. Co., York, Pa.—Bulletin 69. A well-illustrated 30-page booklet describing York vertical single action inclosed refrigerating machine, type Y-16.

Book Reviews

Treatise on Gas Producer Engineering

Thorough Discussion of Commercially Successful Types of Producers Is Feature of This New Work

Reviewed by
W. B. Chapman
President, Chapman Engineering Co.

MODERN GAS PRODUCERS. By *N. E. Rambush*. 545 pages, 356 illustrations. 83 tables. Benn Bros., Ltd., London. Price, 55 shillings. D. Van Nostrand Co., New York. Price, $15.

Before this interesting treatise appeared there were a dozen books on the subject of producer gas and gas producers—now there is but one. Heretofore books about producer gas have neglected, or missed altogether, the most important phase of this subject, which is the making of raw gas in mechanical producers for large heating operations. Mr. Rambush treats this, as well as all other aspects of the subject, comprehensively and ably.

Technical books are apt to be overacademic, as theoretical material is usually more readily obtainable than that which comes only through long and varied experience; but Mr. Rambush gives us a satisfactory amount of both. There are 545 pages and almost as many photographic illustrations, drawings, diagrams and tables.

The major portion of the book is devoted to the consideration of successful producers now on the market. This is as unusual as it is distinctly practical. Occasionally there is a touch of humor, as when the author solemnly asserts that in the hand-operated producers neglect of hand-poking is "sometimes the human tendency."

About one-fourth of Mr. Rambush's work is given over to the consideration of the various theoretical aspects involved in making producer gas. Then follow 240 pages on "Gas Producer Types," which is the most comprehensive discussion of the subject that has ever appeared. Gas producers are classified under ten types; and each type is carefully studied and its advantages and disadvantages are fully set forth.

Under the heading "Mechanically Ashed Producers" there are 37 illustrations and 21 pages of discussion, the emphasis being placed, as it should be, upon the various types that have proved successful. In summing up his conclusions as to what a good mechanical asher should do, his first requirement is that: "It must maintain the lower part of the fuel bed in a steady, continuous-but-slow movement." American designers of gas producers have long been off the track on the question of continuity of ash removal, and only comparatively recently has the truth of Mr. Rambush's dictum become apparent.

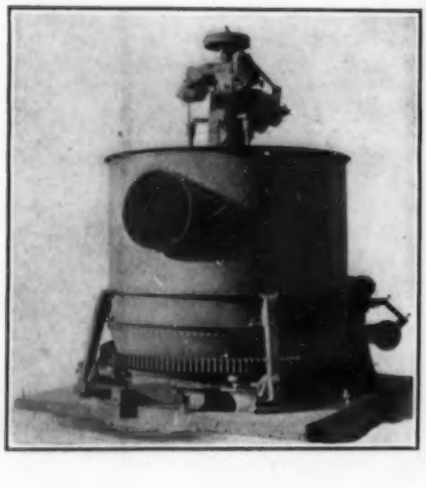
Quoting from page 189: "The grates of mechanical producers are revolved at a very slow speed, generally not quicker than one revolution in 1 hour, nor slower than one revolution in 10 hours; between 3½ and 5 hours being average practice." "Generally speaking, a slow continuous speed gives better gasification results than quick speeds working intermittently."

While this book was being prepared two types of mechanically ashed producers were being developed in America. They have since been placed upon the market and have fully proved the truth of the above statement. As these producers are not treated in the book, they are illustrated herewith to bring the discussion up to date.

Every one interested in gas producer practice should read this distinct contribution to the art. No one not actually in the gas producer business could have produced "Modern Gas Producers."

In conclusion, I wish to state that Mr. Rambush's discussion of the equipment of others who might be considered competitors is eminently fair, and his treatment of his own equipment is commendably modest.

Mechanically Ashed Producers
Two types of mechanically ashed producers have been developed since Mr. Rambush's book was prepared: the Chapman (below) and the Wellman-Seaver-Morgan (right).



Important Technical Articles in Foreign Literature

"The Banana Industry." *Max Winckel.* Bananas are the raw material for a growing industry in Mexico. The products include banana flour, malted flour, dried bananas, flavor, liqueur, wine, cocoa, chocolate and other banana confections. Cattle feed is made from the peel. *Chemiker-Zeitung,* March 27, pp. 178-9.

"Asbestine in the Dye Industry." *Cornelius Duessel.* Asbestine is useful as a filler for dyes of very low specific gravity, and for dyes which are to be resistant to fire, acid or weather. It is also used as a substrate for lime lakes and other cheap lakes. *Chemiker-Zeitung,* March 27, pp. 179-80.

"Adsorption as a Preliminary Stage in Chemical Union." *E. Wedekind.* The relation of adsorption to the combination of As_2O_3 with a hydrogel of ZrO_2 was studied. A reversible adsorption compound preceded the actual salt formation. *Chemiker-Zeitung,* March 29, pp. 185-6.

"The Behavior of Montan Wax Toward Distillation." *J. Marcusson.* The ketones obtained by distilling lignite are derived chiefly from the montan wax. Some of the lower hydrocarbons in petroleum are probably degradation products of such ketones. *Zeitschrift f. angewandte Chemie,* 1924, pp. 35-6; *Chem.-techn. Uebersicht,* March 29, p. 52.

"Mechanical Disintegration in Fertilizer Plants." A description of equipment for the simultaneous pulverizing, sifting and sacking of lump material. *Chemiker-Zeitung,* April 3, 1924, p. 200.

"Acetylene." A refrigeration process is being used to purify acetylene for welding and lighting purposes. Water, tar and ammonia are practically completely removed. *Chemiker-Zeitung,* April 3, 1924, p. 202.

"Sulphonation of Oils, Especially Fish Oils." *Pommerang.* The relatively cheap sulphonated fish oils should be substituted for Turkey red oil and other expensive sulphonated oils. *Chem. Umschau,* 1923, p. 133; *Chem.-techn. Uebersicht,* March 29, p. 56.

Review of Recent Patents

Sodium Citrate

Action of Sodium Carbonate Upon Ammonia Solution of Calcium Citrate Covered by Patent

Walter Glaeser, of Brooklyn, N. Y., has been granted a patent (1,491,390, April 22, 1924) for a process of making sodium citrate that consists essentially in double decomposition of calcium citrate and sodium carbonate. Mr. Glaeser outlines the process as follows:

"Sodium citrate is ordinarily made by dissolving soda in citric acid, which requires, of course, that citric acid be made first, and the manufacture of this compound is expensive. The present invention is based upon my discovery that calcium citrate is completely decomposed when treated in the cold by an aqueous solution of an alkali metal salt, such as sodium carbonate. It is essential that the treatment be carried on at a low temperature, which should be below 30 deg. C., and it is desirable that there be present a small amount of ammonia, as this assists the double decomposition for the reason that calcium citrate is soluble in ammonia. It is not necessary to use sodium carbonate, as other alkali metal salts, such as sodium sulphate or sodium bisulphate or phosphate, may be used to effect the same decomposition of calcium citrate."

Chrome Yellow

Sludge of Basic Lead Sulphate Reacts With Bichromate to Give Desired Pigment

John W. Schumacher, of Detroit, Mich., dispenses in large measure with the use of acetic acid or nitric acid in the manufacture of chrome yellows by starting with a fine suspension of basic lead sulphate.

For the production of a light chrome yellow, 440 lb. of litharge is suspended in 600 gal. of water, 30 lb. of nitric acid is added, and after a few minutes sulphuric acid is slowly run in until 100 lb. has been added. The liquid mass is kept stirred or agitated and is brought to the boiling point by the introduction of steam. This produces a snow-white suspension containing a basic sulphate of lead and other lead compounds. When the reaction has been completed, the liquid mass is run into a precipitation vat and is allowed to cool. A solution of 175 lb. of sodium bichromate dissolved in 300 gal. of water and to which is added 30 lb. of sulphuric acid is slowly run into the precipitation vat while the liquid mass is well agitated, thereby producing the light chrome yellow. The yellow precipitate is settled, washed, filter-pressed and subsequently treated in the conventional well-known manner.

In some instances it is advisable to add ammonium compound, such as ammonium sulphate, before adding the sulphuric acid, the ammonium compound acting as a stimulating agent. A small amount, say 5 to 10 per cent, of such ammonium compounds is frequently helpful, by making the reaction more rapid and hence shortening the time of conversion.

In some industries there is produced, as a byproduct, neutral sulphate of lead precipitate. By taking this material in the form of a pulp, adding a small amount, say 3 to 5 per cent of nitric acid, boiling, agitating and then slowly adding litharge, basic lead sulphate of the character above described can be prepared, of varying degrees of basicity. These basic lead sulphates can be used to produce good commercial chromate pigments, or lead insecticides, by precipitation in the manner above described. (1,484,088; Feb. 19, 1924, assigned to Acme White Lead & Color Works, Detroit.)

Zirconia Refractory

Zirconium Ore Containing Iron Oxide, Titanium Oxide and Silica Found to Bond Satisfactorily

Hugh S. Cooper, of Cleveland, Ohio, has found that zirconium ore with the following analysis can be used successfully for the manufacture of refractory articles without the addition of a separate bonding agent:

ZrO_2	95.24	Fe_2O_3	1.04
TiO_2	0.76	SiO_2	1.08
			98.12

As outlined in Patent 1,491,224 (April 22, 1924, assigned to Kemet Laboratories Co., Cleveland), the process starts with electrical fusion of an ore of this type. This preliminary treatment is desirable to minimize shrinkage of the articles formed from the oxide when subjected to high temperature.

The fused product is then ground to about 80 to 100 mesh. The subdivision may of course be varied, but if the zirconia is too coarsely ground the oxide impurities will not exert a proper bonding action. On the other hand, very finely powdered zirconia is too voluminous to produce articles of the requisite weight and strength.

The ground zirconia is mixed with water, water containing glycerine, or other liquid adapted to yield a plastic mass suitable for pressing into a mold. The mass is preferably compacted into the mold under heavy pressure, for example 35 to 50 tons per sq.in., to insure the requisite density and freedom from objectionable porosity. The mold may be of any desired kind having means for permitting the removal of the formed article without breakage.

After removal from the mold, the article is dried at room temperature for several hours, then heated to about 100 deg. C. for a few days. The article is next transferred to a suitable furnace and gradually raised to a temperature of 1,000 deg. C., after which it is fired at about 1,500 deg. C. The heating at 1,000 deg. C. should be continued for about 24 hours, and the final firing for about 1 hour.

The process as described above produces articles having adequate coherence and strength, as the fritting of the oxide impurities affords a firm bond, reinforcing the relatively low cohesion of the zirconium oxide particles. When present in the amounts indicated, the oxide impurities do not substantially lower the fusing point of the articles nor otherwise detrimentally affect them.

New Publications

THE NATIONAL SAFETY COUNCIL announces the publication of a pamphlet dealing with safe practices in chemical laboratories. The pamphlet describes, in detail, safe practices as they apply to the chemical industry and covers the following subjects: Building, housekeeping, storage of chemicals and apparatus, fire-fighting equipment, gas systems, compressed gas cylinders, glass tubing connections, drinking facilities, dessicators, filling pipettes and starting siphons, acid analysis, nitrometer, drying samples, volatile flammable liquids and disposal of refuse. The pamphlet is well illustrated. Pamphlets are obtainable from the National Safety Council, 168 North Michigan Ave., Chicago, Ill.

THE UNITED STATES PUBLIC HEALTH SERVICE has issued a pamphlet on "Preliminary Note on Observations Made on Physical Condition of Persons Engaged in Measuring Radium Preparations," by R. C. Williams. Reprint No. 889 from the Public Health Reports.

PURDUE UNIVERSITY has issued Bulletin 16 from its Engineering Experiment Station, Lafayette, Ind., on "The Physical Characteristics of Speech Sound," by Mark H. Liddell.

THE IMPERIAL MINERAL RESOURCES BUREAU has issued pamphlets on Fullers Earth (price 6d.); Borates (price 1s. 3d.); and Nitrates (price 2s.), in each case giving statistics from 1919-21. Copies can be obtained from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, England.

NEW BUREAU OF STANDARDS PUBLICATIONS: Circ. 155, Government Master Specifications for Coal-Tar Pitch for Waterproofing and Damp Proofing; Circ. 159, Government Master Specifications for Asphalt for Mineral-Surfaced Roofing; Circ. 162 Government Master Specifications for Asphalt Primer for Roofing and Waterproofing; Scien. Paper 483, Determination of Iridium in Platinum Alloys by the Method of Fusion With Lead, by Raleigh Gilchrist, price 5c.; Scien. Paper 484, Determination of the Critical Ranges of Pure Iron-Carbon Alloys by the Thermo-electric Method, by J. F. T. Berliner, price 5c.; Tech. Paper 252, The Nick-Bend Test for Wrought Iron, by Henry S. Rawdon and Samuel Epstein, price 10c.

NEW U. S. GEOLOGICAL SURVEY PUBLICATIONS: I: 27, Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium, Uranium and Vanadium in 1922, by Frank L. Hess (Mineral Resources of the U. S., 1922, Part I), published March 14, 1924; II: 1, Sulphur and Pyrites in 1923, by H. M. Meyer (Mineral Resources of the U. S., 1923, Part II), published April 21, 1923; II: 28, Stone in 1922, by G. F. Loughlin and A. T. Coons (Mineral Resources of the U. S., 1922, Part II), published April 10, 1924; II: 30, Natural-Gas Gasoline in 1922, by G. B. Richardson (Mineral Resources of the U. S., 1922, Part II), published April 24, 1924; II: 31, Natural Gas in 1922, by G. B. Richardson (Mineral Resources of the U. S., 1922, Part II), published April 26, 1924.

THE IMPERIAL MINERAL RESOURCES BUREAU (London) has published statistics from 1919 to 1921 on Platinum and Allied Metals (price 1s. 3d.); Feldspar (price 6d. net); Sulphur (price 1s. 6d. net); Manganese (price 1s. 6d.); and a booklet on Petroleum and Allied Products (1913-1919); price 6s. 6d. net. Copies can be purchased from His Majesty's Stationery Office, London, England.

American Patents Issued May 6, 1924

1,492,555—Mold for Forming Articles From Pulp or Other Plastic Material. Simon Cooper, Brooklyn, N. Y., assignor to Vacuum Pulp Products Corporation, New York.

1,492,563 — Paper - Making Machine. Frank A. Headson, Milwaukee, Wis.

1,492,567—Process of Making High-Speed Steel Tools. Frederick C. Langenberg, Cambridge, Mass.

1,492,568—Device for Use in Quenching Annular Articles. Marcus T. Lothrop, Canton, O., assignor to Timken Roller Bearing Co., Canton, O.

1,492,578—Opaquing Composition for Enameling Mixtures and Process of Making Same. Josef Perino, Sewickley, and Robert D. O'Neil and Frank G. Gramm, Coraopolis, Pa., assignors to Vulcan Detinning Co., Sewaren, N. J.

1,492,579—Gas Trap for Oil Tanks and the Like. Felbert A. Ray, Wichita Falls, Tex.

1,492,591—Calender or the Like. David R. Bowen, Ansonia, Conn., assignor to Farrel Foundry & Machine Co., Ansonia.

1,492,592—Coating Apparatus. John W. Cosgrove, Medford, Mass., assignor to United Shoe Machinery Corporation, Paterson, N. J.

1,492,594—Spinning Jet or Nozzle for the Manufacture of Artificial Silk, Etc. Camille Dreyfus and Guy Leonard, Cumberland, Md., assignors to American Cellulose & Chemical Manufacturing Co., Ltd., New York.

1,492,602—Machine for Working on Glass. Walter J. Leveridge, Mount Vernon and Paul Schwerin, New York, N. Y., assignors to Western Electric Co., Inc., New York.

1,492,605—Tank for Vacuum Drying Apparatus. Otis D. Rice, Winthrop, Mass.

1,492,636—Process for the Manufacture of Chromates and Bichromates. Adolphe Jouve and Andre Heldbronner, Paris, France.

1,492,641—Method of and Apparatus for Welding. Simon Lake, Milford, Conn.

1,492,656—Counter-Current Lixiviator. John W. Turrentine, Santa Barbara, Calif., dedicated, by mesne assignments, to the People of the United States for their free use and enjoyment.

1,492,661 — Process for Forming Chemical Compounds. Edward E. Arnold, Coventry, R. I., assignor to the Nitrogen Corporation, Providence, R. I.

1,492,665—Process for the Manufacture of Anthranilic Acid. Frank H. Beall, Baltimore, and Donald B. Bradner, Edgewood, Md.

1,492,685 — Refractory Lining for Metallurgical Purposes. Edwin W. Hale, Greenwich, Conn.

1,492,697—Machine for Flushing Sausage Casings and the Like. George E. Neuberth, Newark, N. J.

1,492,712—Process for the Production of Phosphorus and Potash Compounds. Bethune G. Klugh, Chicago, Ill., assignor to Federal Phosphorus Co., Birmingham, Ala.

1,492,713—Process for the Production of Oxides of Phosphorus. Bethune G. Klugh, Chicago, Ill., assignor to Federal Phosphorus Co., Birmingham, Ala.

1,492,715 — Dentifrice. Rudolph A. Kuever, Iowa City, Iowa, assignor to the Pepsodent Co., Chicago, Ill.

1,492,717—Method of Concentrating Aqueous Solutions of Volatile Substances. F. E. Lichtenthaeler, Newton Highlands, Mass.

1,492,718—Method of Concentrating Aqueous Solutions of Volatile Substances. Frank E. Lichtenthaeler, Newton Highlands, Mass.

1,492,742—System for Handling Viscous Fluids. Homer H. Norton and Elmer E. Hobbs, Philadelphia, Pa.

1,492,753—Ceramic Product. J. Schumacher, Los Angeles, Calif.

1,492,775 — Pulverized-Fuel-Burning Apparatus. Virginius Z. Carachristi, Bronxville, N. Y., assignor to Locomotive Pulverized Fuel Co.

1,492,794—Method and Apparatus for Screening and Refining Paper Stock. Anton J. Haug, Nashua, N. H., assignor to Improved Paper Machinery Co., Nashua.

1,492,795—Method and Apparatus for Separating Foreign Matter From Paper Stock. Anton J. Haug, Nashua, N. H., assignor to Improved Paper Machinery Co., Nashua.

1,492,804—Heat-Treatment of Metals and Apparatus Therefor. Harry P. Macdonald, Montclair, N. J., and Angus S. Macdonald, Great Neck Station, N. Y., assignors to Snead & Co. Iron Works, Jersey City, N. J.

1,492,810—Manufacture of Calcium Sulphide, Etc. William N. Rossberg and Guy E. Sheridan, Butte, Mont.

1,492,818 — Process of Producing Sponge Iron. Edwin B. Thornhill, Hurley, N. M.

1,492,866—Acid-Proof Cement Lining for Digesters of Sulphite Pulp. Naoki Takata, Tokyo, Japan.

1,492,871—Method for Production of Cyanogen Compounds. Foord Von Bichowsky, Glendale, Calif.

These patents have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

1,492,905—Method and Apparatus for Unloading High-Explosive Shells. Joseph G. Swanick, Fords, N. J., assignor to Columbia Salvage Corporation, New York.

1,492,920-21—Process of Producing Sodium Borates. Harold P. Knight, Borosolvay, Thomas M. Cramer, Oakland, and George A. Connell, Alameda, Calif., assignors to Pacific Coast Borax Co.

1,492,922-23-24-25—Method and Apparatus for Unloading High-Explosive Shells. Thomas F. Knight, Lyndhurst, N. J., assignor to Columbia Salvage Corporation, New York.

1,492,926 — Dehairing Mechanism. Louis A. Kramer, Chicago, Ill.

1,492,942—Edge-Holding Device for Sheet-Glass Machines. Harry G. Slingluff, Mount Vernon, Ohio, assignor to Pittsburgh Plate Glass Co.

1,492,949—Shell-Salvaging Apparatus. Gustave Allison, Perth Amboy, N. J., assignor to Columbia Salvage Corporation, New York.

1,492,956-57-58—Method and Apparatus for Unloading High-Explosive Shells. Richard H. Bots, New York, N. Y., assignor to Columbia Salvage Corporation, New York.

1,492,964 — Preserving Fruit Juices. Frank E. Coombs, San Francisco, Calif.

1,492,969—Treatment of Liquid Hydrocarbons. Albert E. Dunstan, Sunbury-on-Thames, England.

1,492,973—Steel Alloy. Charles T. Evans, Titusville, Pa., assignor to Cyclops Steel Co., New York, N. Y.

1,492,975—Process and Apparatus for Making Sheet Glass. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co.

1,492,991—Process of Electric Welding. Laurence S. Lachman, New York, N. Y., assignor to Universal Electric Welding Company, Long Island City, N. Y.

1,492,992—Composite Metal Work and Method of Making Same. Maurice Lachman, Laurence S. Lachman, and Edward Fulda, New York, N. Y., assignors to Universal Electric Welding Co., Long Island City, N. Y.

1,492,997—Continuous Reduction Process for Treating Waste Organic Matter. Angus Maclachlan, Perth Amboy, N. J., assignor to Maclachlan Reduction Process Co., New York, N. Y.

1,493,000—Making Photographic Films. Sterne Morse, Yonkers, N. Y.

1,493,012—Rustproofing Process and Compound. Charles E. Abraham, Detroit, Mich.

1,493,039—Process for the Manufacture of Metals or Alloys Poor in Carbon and Silicon. Bo Michael Sture Kalling and Sven Dagobert Danieli, Trollhattan, Sweden, assignors to Aktiebolaget Ferrolegeringar, Stockholm, Sweden.

1,493,062—Soft-Rubber Product and Method of Making It. Edward O. Benjamin, Newark, N. J.

1,493,092—Art of Removing Flue Dust From Containers. Ralph W. H. Atcherson, Indiana Harbor, Me.

1,493,099—Manufacture of Phosphate Salts and Phosphoric Acid. Charles Bramson, Joliet, Ill.

1,493,100 — Treating Mineral Phosphates. Charles Bramson, Joliet, Ill.

1,493,111—Detergent and Process of Making the Same. Robert H. Divine, Cincinnati, O.

1,493,126—Process of Making Elemental Sodium From Borax. Samuel Peacock, Wheeling, W. Va., assignor to Willis G. Waldo, Washington, D. C.

1,493,182—Process for Production of Diethylchloracetamide. Jean Altwegg and Paul Pivot, Lyon, France, assignors to Société Chimique des Usines du Rhone, Paris, France.

1,493,183—Process of Purifying Carbon Dioxide. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.

1,493,191—Alloy. Anthony G. de Golyer, Brooklyn, N. Y.

1,493,205—Cleaning of Metals by Electrolysis. Isidore Jascowitz and John Rosenbaum, London, England, assignors to R. J. Corporation, Ltd., London, England.

1,493,206—Process and Means for Preventing One of Two Centrifugally Separated Liquids From Contaminating the Other. Hans O. Lindgren, Stockholm, Sweden, assignor to De Laval Separator Co., New York.

1,493,207—Cellulose Composition and Process. William G. Lindsay, Newark, N. J., assignor to the Celluloid Co.

1,493,208—Cellulose Composition and Process. William G. Lindsay, Newark, N. J., assignor to the Celluloid Co.

1,493,209—Plastic Composition. William G. Lindsay, Newark, N. J., assignor to the Celluloid Co.

1,493,210 — Cellulose Composition. William G. Lindsay, Newark, N. J., assignor to the Celluloid Co.

1,493,297—Process of Manufacturing Gas. Walter E. Trent, Washington, D. C.

1,493,320—Process for Manufacturing Aluminum Hydroxide. Max Buchner, Hanover, Germany.

1,493,347 — Non-Explosive Mass-Supplying High-Tensioned Gases From Combustion. W. Kockmann, Berlin-Charlottenburg, Germany.

1,493,370—Method of Making and Vulcanizing Dipped Rubber Articles. Thomas W. Miller, Ashland, O.

1,493,371—Asbestos Paper. William J. Moeller, Cincinnati, O.

1,493,382 — Wood Grinder. Paul Priem, Heidenheim-on-the-Brenz, Germany, assignor to American Voith Contact Co., Inc., New York, N. Y.

1,493,388—Apparatus for Analyzing Gas Mixtures. Olaf Rodhe, Stockholm, Sweden, assignor to Svenska Aktiebolaget Mono, Stockholm, Sweden.

1,493,392—Manufacture of Brown Flour. William T. Ryle, Thornton Heath, England.

News of the Industry

Summary of the Week

Tariff Commission is said to have issued report favoring increase in duty on imports of barium dioxide.

Senate Committee on Agriculture voted to report favorably Sheppard bill providing for prospecting for potash in the Southwest.

Maintenance of chemical trade commissioner in Europe may be discontinued after retirement of F. E. Breithut.

Farm Bureau opposes Ford control of Muscle Shoals. Action on disposal demanded at present session in Senate but chances for final action are considered poor.

Chilean Nitrate Producers Association will refuse to sell nitrate to firms who deal with non-associated companies.

Japanese display of interest in helium may stir interest of Congress in bill protecting American supply.

South Jersey glass plants give evidence of prosperity during coming season.

Union Carbide freed of charges of violation of Sherman law.

Columbia announces course in gas manufacture during coming summer.

Producers of Chilean Nitrate Place Restrictions on Sales

Will Not Sell to Purchasers Who Deal With Oficinas Outside the Association—Prominent Domestic Interests Say This Ruling Has No Bearing on Trade With American Firms

WITH its corporate life extended until June 30, 1930, the Chilean Nitrate Association is embarking on more militant tactics than have been attempted heretofore, cable advices to the Department of Commerce indicate. The association has taken formal action whereby its members are precluded from selling to any one making purchases from non-member producers. Brokers and middlemen who handle the products of the American or other producers who do not belong to the association also in effect are blacklisted. Apparently as a part of the same program, the Chilean Government announces that its nitrate lands will be sold only to members of the association.

Difficult Situation Created

It is recognized that these steps have precipitated a situation of real difficulty for the American producers of Chilean nitrate and for the other companies that have refused to enter the association. The Chilean producers outside of the association—and they produce only 1.75 per cent of Chile's output—will not suffer great losses even if they are forced to join the association. It is fully expected that they will do so in view of the coercive policy that has been adopted.

The cablegram telling of the resolution to restrict sales passed by the producers reads as follows:

"Directorate passed the following resolution: Associated producers have authorized Chilean Nitrate Producers Association not to sell its nitrate to any purchasers who from date of this circular may purchase nitrates produced in non-associated oficinas or who may purchase for account of or resale to them nor will it attend to negotiations of brokers who from this date shall have intervened in operations of nitrates produced in non-associated oficinas."

Prominent factors in the domestic nitrate trade say this ruling has no significance as far as sales to American producers and dealers are concerned. While the resolution apparently is inclusive, they say it is meant to place restrictions only on Chilean companies which are not members of the producers' association. However, if the ruling includes American firms, the latter will be in a position of disadvantage. The American anti-trust statutes forbid their participation in a price-fixing combine, such as is the organization of Chilean producers. On the other hand, they probably are not in a position to appeal to the State Department, because their business is dependent to a considerable extent on the maintenance of friendly relations with the Chilean Government and the Chilean people.

U. S. Not Expected to Protest

Even were the American producers to appeal to the State Department, there is no certainty that this government would make an issue of the matter. To start with, we legalize export combinations ourselves. Foreign steamship lines long have refused, when it was to their interest to do so, to handle any consignments for a shipper unless all his shipments were made in their bottoms. In one instance the merchants in an American port started a small steamship line to furnish transportation to a South American country where there was an insistent demand for certain American goods. Full cargoes could be obtained for outgoing voyages and it was assumed that return cargoes would be easy to obtain, as there were very large importations from the country through that port. That service was performed by a foreign line on the so-called three-legged plan. The ships of that line carried merchandise from Europe to South America. There they picked up cargo for the United States. At the American port they reloaded with shipments for Europe. Under this plan the American merchants had no opportunity to ship to South America. The establishment of their own line brought forth an edict from the foreign lines that any shipper using the American line could not ship on their vessels. No one of the South American shippers was in the position to be denied the more adequate service, so the merchants had to discontinue their steamship service, as absolutely no return cargo could be obtained. This was called to the attention of the State Department, but no action was taken. With this precedent in mind, it seems probable that the American companies engaged in the production of sodium nitrate in Chile probably would secure no relief even were they to appeal to the State Department.

The Chilean Association has announced reductions in prices. The reduction is regarded more as a gesture

than anything substantial. The object is thought to be to discourage research on synthetic processes.

The latest action of the nitrate producers, in the opinion of Washington officials, is calculated to stimulate interest—particularly governmental interest—in the fixation of atmospheric nitrogen. The policy will make it clear to all legislators that the only real relief must be found in the perfection of a synthetic process which can compete with Chilean nitrates. It is certain that Congress will be very liberal in appropriations for research work. It also is certain that any disposition that may be made of Muscle Shoals will carry with it absolute assurance of a broad program of research work on this problem.

Columbia Repeats Its Summer Course in Gas Manufacture

The department of chemical engineering of Columbia University announces that the course on production and distribution of manufactured gas will again be given during the summer session, July 7 to Aug. 15, 1924.

The course is in charge of Prof. Jerome J. Morgan, who has had practical experience in the gas industry, and includes both lectures and laboratory work. In the lectures the main object is not to give detailed information about gas works practice, but rather to point out where such information can be obtained and to discuss fully from the chemical engineering standpoint the reasons underlying the various steps in modern practice. The discussion includes raw materials for gas making; carbonization at high and low temperatures: oil and blue gas processes; complete gasification; purification of gas; utilization of byproducts; distribution and utilization of the finished product.

To aid the members of the class in getting first-hand information on present practice, five plant inspection trips and several special illustrated lectures are arranged. The special lectures are by men prominent in the gas industry and cover such subjects as: vertical retorts; coke ovens; water gas set construction; cracking of hydrocarbon oils; ammonia recovery; laboratory control; distribution and utilization problems; industrial heating; evaluation and gas rates.

Oil Industry Safety Code Drawn

Under the direction of Claude Connally, Oklahoma State Labor Commissioner, a safety code is being developed covering all branches of oil production, oil lease operation and manufacture of gasoline, as well as tank and other equipment installations. The code will be operative in the mid-continent fields and a tentative draft has been approved by representatives of the state labor departments of Texas, Arkansas, Kansas and Louisiana. The completed safety code, as decided upon by the State of Oklahoma, will be submitted to the other states for individual ratification. Oil producers and insurance companies are also expressing interest in the proposed measures for workmen's safety.

Farm Bureau Is Against Acceptance of Ford's Muscle Shoals Offer

Action During Present Session Becoming Unlikely Despite Demands in Senate—Controversy Still Continues at High Pitch

SENATOR REED of Missouri fired a broadside at Henry Ford and his offer for Muscle Shoals in the Senate last week. His attack, in view of the other opposition to acceptance of the Ford offer, is looked on as foreshadowing its rejection in the Senate. Indications now are that the Muscle Shoals proposal will not come to a vote at this session.

That some of the farm organizations are not behind the Ford offer for Muscle Shoals and that an absence of generosity has been detected in the distribution of Mr. Ford's ammonium sulphate is indicated in a letter from Harry S. Kapp, the secretary and manager of the Louisiana Farm Bureau Federation. The letter has been embodied in the record of the hearing in progress before the Senate Committee on Agriculture. A portion of it is as follows:

"Some time last fall the local Ford dealer in Baton Rouge came into our office and proposed to furnish us some of Ford's sulphate of ammonia. At that time he was producing a small quantity from some of his plants in the North.

"When we reduced the ammonia content of the Ford product to nitrogen and then compared it with the nitrogen content of nitrate of soda that we are handling and the price at which it was proposed to furnish the sulphate of ammonia, we found that Mr. Ford had priced his product at only a few cents less than nitrate of soda. His proposition was that the price should be $60 per ton, with the freight added. This would make his product delivered in Baton Rouge cost $67.50 per ton.

Agents' Commission, $6 a Ton

"In going into the matter further with a view of arranging a business deal, if practicable, the Ford agent stated to us that Ford's product was to be handled entirely through his auto agencies and that the auto agent would receive a commission of 10 per cent for so handling.

"Ten per cent of $60 means $6 per ton profit to the Ford agent that the farmer would have to pay. The local dealers everywhere are glad to handle fertilizer on the basis of $1 or $2 per ton and the Louisiana Farm Bureau Federation is distributing nitrate to the farmers of Louisiana on a basis of 50c. per ton. I immediately stated to the Ford agent that the Farm Bureau would not enter into any business deal with any firm that proposed to penalize the farmer at the rate of $6 per ton for handling fertilizer.

"I am not at all informed as to what methods of distribution Mr. Ford would propose in the event he secures Muscle Shoals. As far as I am able to learn, the idea is to make the Ford agencies throughout the country the distributing agent for his product. If this is true, then Mr. Ford will create a wonderful machine in every city and hamlet of the United States, absolutely controlling nitrate and having in his hands the cost of the same and the cost of distribution. If the cost of distribution is to be based on 10 per cent, then I think Mr. Ford would be a great detriment to the agriculture of the United States.

"Another proposition is that in a recent issue of the Dearborn *Independent* his paid workers are making a most outrageous attack upon all of the co-operative marketing associations. In view of this, it seems to me that Mr. Ford evidently is an erratic man looking particularly after Ford's interest and not in sympathy with farmers and co-operative selling.

"In the event that Mr. Ford is interested in the Muscle Shoals project, it seems to me that it would be quite wise for the Congress of the United States to insist upon such distribution of nitrates as would take it out of the hands of the Ford agencies."

Davis Defends Carbide Offer

D. H. Davis, representing the Union Carbide Co., told the Senate committee that his organization's proposals for operating Muscle Shoals were the only proposals embodying a clear-cut program of manufacture by a definite process of a fertilizer of "demonstrated superior merit."

While the Southern power companies have included in their bid for Muscle Shoals a proposal to form a corporation to produce fertilizer and offer to set aside at cost 100,000 hp. from the hydro-electric development for this purpose, with an additional 40,000 hp. if demanded on rates to be fixed by the Federal Power Commission. E. A. Yates, general manager of the Alabama Power Co., in his testimony predicted that within a few years the consumption of large units of electric energy in the manufacture of fertilizer ingredients will be rendered unnecessary because of improved methods.

The power companies—the Alabama Power Co., the Tennessee Electric Power Co. and the Memphis Power & Light Co.—propose to organize a $5,000,000 corporation to produce fertilizer at a profit not to exceed 8 per cent, the government to share in the profits. They also offer to set aside a research fund of $1,000,000. They would lease nitrate plant No. 1 for this purpose, and would maintain nitrate plant No. 2 in a standby condition for the production of explosives in the event of war. For the hydro-electric development, these companies offer $10,000,000 a year for dam No. 2 for 50 years; either to lease or to purchase the steam plant of nitrate plant No. 2 and to lease or construct themselves dam No. 3. Mr. Yates told the committee this offer would yield a return of $140,000,000 to the government in 50 years.

Washington News

Favorable Report for Sheppard Potash Bill

The Senate Committee on Agriculture has voted to report favorably a bill introduced by Senator Sheppard of Texas, providing for a 5-year program, under which the Geological Survey will do extensive prospecting for potash in the Southwest. Senator Sheppard's bill calls for expenditures at the rate of $500,000 annually. As this is written, the committee is disinclined to authorize so large an amount, but it will support a proposal looking to the extensive use of core drills in those areas of the Southwest where the rotary drills of the oil wells have brought potash to the surface but which give no indication of the width of the bed they have penetrated.

In connection with this legislation, it is pointed out that while most is heard about the use of potash in fertilizer, it is also a very important material in the manufacture of soap, glass, matches, dyeing and tanning materials, photographic supplies and explosives.

Since it has been established that potash exists in the Southwest, where the geological conditions are fully as favorable to its appearance as they are in Germany and in Alsace, it is believed that a federal appropriation will be forthcoming that will permit of further prospecting.

Drug Trade Makes Progress in Standardizing Containers

Standardization of containers and the simplification of drug catalogs, which practically has been at a standstill for some months so far as the Department of Commerce is concerned, is being revived because of a growing demand in the drug trade for better practice in those particulars. Although the negotiations with the Division of Simplified Practices have been at a standstill, it is pointed out that the trade itself has continued the very decided progress in this direction that has been going on for some years. It is believed, however, that the point has been reached where a more formal agreement must be entered into if the progress is to be continued.

While the Division of Simplified Practices is particularly proud of the work it did in co-operation with the manufacturers of paints and varnishes and with the manufacturers of explosives, those are the only instances in which the Department of Commerce has co-operated with industries of a chemical character. In that connection, it is pointed out that simplification and the reduction of excess variety has proceeded much further in some activities than has been the case with chemical industries.

The work of the Department of Commerce in simplification and elimination of waste is regarded as one of the outstanding constructive things accomplished by this administration. For that reason there is a particular desire to do more than has been done in the chemical industry.

Larger Output of Phosphate Rock in 1923

Preliminary figures from the Department of the Interior show that 2,998,500 long tons of phosphate rock, valued at $11,396,900, was shipped from mines in the United States in 1923. Florida, the leading state, shipped 2,555,400 tons, worth $8,984,800, more than nine-tenths of which was land-pebble phosphate. Shipments from Tennessee and small amounts from Kentucky were 437,900 tons, worth $2,387,100. Idaho and Wyoming made small shipments.

The phosphate rock mined in the United States in 1923 amounted to 2,857,700 long tons, which is 22 per cent more than that mined in 1922. More than four-fifths of it was mined in Florida. Most of the remainder was mined in Tennessee and Kentucky, though a small quantity was mined in Idaho and Wyoming.

Successor to Breithut May Not Be Appointed

As Dr. F. E. Breithut insists upon an early return to his classes at the College of the City of New York, the Department of Commerce is weighing the question as to whether or not to continue the maintenance in Europe of a trade commissioner with an intimate knowledge of chemical industries. While the department is acquainted with the fact that the representatives of certain groups in the chemical industry are anxious that one of the trade commissioners in Europe be a chemist, officials are not sure that the benefits accruing from this plan are sufficient to justify what is to a bureau with limited appropriations a relatively heavy expenditure.

Another difficulty that faces the department is the fact that a chemist with broad training cannot be induced to take such a place at a salary of $5,000 unless he is willing to make a financial secrifice in return for the experience he could gain.

The probabilities are that no successor to Dr. Breithut will be named unless there should be some evidence of a very decided feeling in the industry that such service would be of important value in connection with our foreign trade.

Production of Fats and Oils in First Quarter of Year

The Department of Commerce announces that the factory production of fats and oils, exclusive of refined oils and derivatives, during the three-month period ended March 31, 1924, was as follows: Vegetable oils, 566,638,131 lb.; fish oils, 5,313,802 lb.; animal fats, 715,221,923 lb.; and grease 103,162,128 lb.; a total of 1,390,335,984 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 607,831,620 lb., appears for edible and neutral lard. Next in order is cottonseed oil with 289,928,082 lb.; linseed oil with 177,583,004 lb.; tallow with 105,360,866 lb.; coconut oil with 52,684,453 lb.; and corn oil with 32,986,193 lb.

The production of refined oils during the period was as follows: Cottonseed, 275,295,592 lb.; coconut, 50,391,523 lb.; peanut, 1,358,431 lb.; soya-bean, 978,660 lb.; corn, 25,440,428 lb.; and palm-kernel, 168,403 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

Japanese May Hasten Helium Action in Congress

Impetus will be given the helium bill, it is believed, by the fact that the Japanese appreciate its value sufficiently to undertake to locate supplies of it in the gases escaping from their volcanoes. If the Japanese will go to such lengths in their quest for helium, it will be easier to convince members of Congress that we should not allow our resources of this valuable gas to be lost when they could be saved with comparatively little difficulty or expense.

As this is written, no exact date has been fixed for the consideration of the helium bill on the floor of the House, but it is belived such arrangement will be made. It is practically certain that the House will pass the bill before adjournment for the political conventions. The situation in the Senate is not so favorable, due to its congested calendar, but House action may pave the way for a vote on the measure in the Senate. If it can be brought up, it is practically certain to pass.

Increase Expected in Duty on Barium Dioxide

The Tariff Commission May 14 sent to the President its report of an investigation into costs of production of barium dioxide which it conducted as the result of applications for changes in the rate of duty under the flexible tariff. It is understood that the report indicates justification for an increase of 50 per cent in the duty, the maximum increase under the law. Two applications were filed with the commission on barium dioxide. One by the J. H. R. Products Co., Willoughby, Ohio, asked an increase in the duty and one by John Bene & Son, Brooklyn, asked a decrease.

Chemical Foundation Suit Will Have Hearing in October

Federal Court of Appeals refused a request by Solicitor General James A. Beck, in the suit of the government against the Chemical Foundation for recovery of 4,800 German dye patents, that the case be heard in June and ordered the case on the list for an early hearing in October.

News in Brief

Core Oil Research at Ann Arbor—The engineering research department of the University of Michigan, Ann Arbor, will soon begin research on core oils for foundry service and experimental work in connection therewith. The research will be carried on under the direction of Prof. H. L. Campbell, and has been made possible through a fund provided by the Detroit Foundrymen's Association, of which K. C. Babo is president.

Standard Plate Glass Expands—Following the recent purchase of the Watson Paint & Glass Co., Pittsburgh, Pa., by the Standard Plate Glass Corporation, of the same city, the last-noted company has extended its acquisitions to include the Zenn Paint & Glass Co., Youngstown, Ohio, and the Bison Paint & Window Glass Co., Buffalo, N. Y., both properties to be merged with those of the purchasing company. Other expansion plans are under consideration.

Diamond Alkali Opens Coke Plant—The Diamond Alkali Co., Fairport, Ohio, has begun operations at its new local coke plant, recently completed, and purposes to place the unit on a full production basis at an early date. Artificial gas from the plant will be furnished for general consumption at Ashtabula, Ohio, being purchased by the Ashtabula Gas Co. for distribution. It will be conveyed through a pipe line about 28 miles long. The service has been inaugurated.

Canadian Concern Granted Sweeping Rights—The Canadian Government has granted incorporation to the British Wainwright Oil & Development Co., Ltd., which, with a capital of $750,000, proposes, among other things, to purchase or lease oil lands, or the oil and gas rights in lands, mining rights, alkali rights, mines and metallurgical lands in various parts of the dominion. Headquarters will be in Calgary, Alta. The incorporators are Abram Peter Van Buren, advertising agent; R. A. Price and R. E. Lamont of Calgary.

Arsenic and Copper Found in Sweden—A Reuter dispatch from Sweden states that large deposits of copper ore, pyrites and arsenic ore, the last named holding 30 per cent of arsenic, have been found in the province of Vaesterbotten not far from the rich copper and sulphur deposits discovered at Bjurfors. M. Gafvelin, the Chief Royal Geologist, says that the deposits may prove very valuable, especially as arsenic ore has not previously been found in Sweden. An investigation of the new deposits is being made on the initiative of the holding company, Centralgruppens Emissionsaktiebolag.

New Arkansas Oil Refinery Opens—The Lion Oil Refinery Co., El Dorado, Ark., has commenced operations at its new local oil refinery, recently completed, and the plant is now handling on a basis of 7,000 bbl. of crude oil per day from the Smackover field. It has been designed to handle a maximum of 10,000 bbl. daily, and will be developed to this point in the near future.

Oregon Soda Deposits May Be Developed—At a hearing recently before Examiner Wagner of the Interstate Commerce Commission, H. L. Emerson, representing the General Petroleum Co. of California and the Spreckels interests, San Francisco, jointly, placed these firms on record to erect the first unit of a soda reduction plant at Alkali Lake, in central Oregon, to cost $300,000, if the commission would approve an order providing railway service to that section of the state. Surveys by engineers are reported to have shown that there are between 500,000 and 800,000 tons of soda there which will run 97 or 98 per cent pure. The location is now 135 miles from the nearest terminus of the Union Pacific lines. The Portland Chamber of Commerce is also working to secure the rail connection.

Patent Office Examination Coming Soon—The United States Civil Service Commission states that it will hold an examination on June 4 and 5 to fill 100 newly created positions of assistant examiner in the United States Patent Office. The time required for taking this examination has been reduced from 3 to 2 days. The entrance salary is $1,860 a year, and increases are provided up to $5,000 a year. The examination includes mathematics, technics, physics, interpretation of mechanical drawings, and some branch of engineering. Both men and women will be admitted.

New Canadian Cement Plant—The National Cement Co. is erecting a plant in the town of Montreal East, just outside of the city of Montreal. The first unit of the plant will have a capacity of 900,000 bbl. per annum.

Increase in Mexican Oil Field Activities Seen—One of the most momentous developments in oil operations in the Republic of Mexico will be witnessed during the next few years, according to representative oil men who have long followed closely developments in oil fields of Mexico and southwestern sections of the United States. This development will be the opening up for oil of vast stretches of territory in interior Mexico, most of this territory being near the Texas border, in the states of Coahuila, Nuevo Leon and Tamaulipas. Some of the largest oil interests of the world are preparing for this development and have quietly acquired leases on enormous tracts south of the Rio Grande.

Old Hickory Silk Plant Started—As initial work on the $4,000,000 fiber silk plant for the Du Pont Fibre Silk Co., at Old Hickory, Nashville, Tenn., a 5-story 65x80-ft. brick and steel chemical laboratory will be erected and fully equipped.

Hankow Shipped 24,000 Bbl. of Wood Oil in March

Consul-General P. S. Heintzelman, Hankow, China, reports by radio under date of April 21, that wood oil crop conditions are good. The estimated supply on hand at Hankow is 600 tons, unfilled orders amount to 400 tons. Shipments and internal movements are slow, due to disturbed political conditions and low water. March exports to all countries amounted to 24,000 bbl., of which 525,000 gal. was exported to the United States. Prices during March ranged from taels 23 to taels 26.90 per picul. Conditions indicate a steady market, with the future uncertain. The bad internal conditions are adversely affecting the wood oil trade.

Jersey Glass Plants Active

The majority of glass-manufacturing plants at Glassboro, Millville and other points in south New Jersey are maintaining full operations with sufficient orders ahead to insure continuous operations until well into summer. The usual "summer stop" schedule will be observed in only a very few plants, and those primarily such as are turning out hand-blown ware. Practically all of the machine-blown plants will continue on the active list. There has been a heavy demand for bottles and containers for the drug trade and plants devoted to this line have been running under a maximum schedule, with large increased output through the manufacture of such bottles in clusters on the latest models of automatic bottle-blowing machines.

Trade Notes

Major Walter C. Baker, of the Chemical Warfare Service, has been nominated by the President for promotion to the rank of lieutenant colonel.

R. L. Peeler has succeeded I. W. Fuqua as president of the California Petroleum Corporation and its subsidiary the Petroleum Midway Co.

S. Marshall Evans died at his home in Essex Fells, N. J., on May 9. He was president of the Evans Lead Co. of Charleston, W. Va., and formerly was vice-president of the Eagle-Picher Lead Co. Mr. Evans was well known in paint trade circles and in 1922 was elected president of the National Paint, Oil, and Varnish Association.

William J. Highfield, an official of the Assateague Fish Oil & Fertilizer Company, of Wilmington, Del., has purchased the plant and equipment of the concern at receiver's sale. The plant, erected in 1921, cost $400,000 and was sold for $17,000. It is reported it will be operated by New York capitalists.

J. B. Gambrell, formerly with the Trion Co., is now acting as representative of Stein, Hall & Co., with headquarters at Atlanta, Ga.

A. E. Hofer of Eugene Suter & Co., left last week on a business trip which will include several European countries.

Chemical Salesmen Frame Rules for Returnable Containers

The committee on standardization of trade practices with regard to returnable packages, which was appointed about a year ago by the Salesmen's Association of the American Chemical Industry, has submitted its report. T. W. Sill is chairman of the committee, and other members are B. R. Tunison, R. J. Quinn, A. M. Hopper, J. M. Keating and C. O. Lind. The committee in reporting stated that based on the experience of the great majority it recommends the following basis for handling steel drums, glass carboys, gas cylinders or metal flasks:

1. Containers should be billed at the time of shipment of the goods and should be paid for upon payment of invoice without any special discount.

The following rates should apply at present, subject to fluctuation in cost of constructive materials: 5-gal. lead carboys, $15; 55-gal. drums, $10; 110-gal. drums, $15; 150-gal. gas cylinders, $20; carboys, $5; 1-ton gas cylinder, $200; 5-gal. glass carboys, $3; hardwood barrels (for acetic acid and sodium bisulphite), $5.

2. Containers which have been so charged should be returnable for full credit within 90 days from date of invoice, freight prepaid to point of original shipment, provided that the containers were issued by the original shipper and are in as good condition as at the time of original shipment, due allowance being made for ordinary wear and tear, and have been used for no other purpose than storage of original contents. In case containers are not in such good shape, or have been used otherwise, practical credit may be allowed by original shipper dependent upon its condition.

3. Inasmuch as payment for containers is insisted upon with payment of goods, prompt repayment should in turn be made immediately upon arrival and after inspection at destination.

4. No containers should be returnable after 180 days have elapsed from time of original shipment and a deduction of $1 per month should be made for each month in which containers may be outstanding beyond the 90-day period allowed. As for the handling of wooden barrels, boxes, bags and 1- to 10-gal. cans, we find that in the great majority of cases the cost of these containers is included in the original cost of the goods and no credit is allowed for return. However, in the case of some heavy wooden barrels or various special type containers which contain materials which but slightly affect the container, optional credit may be allowed in proportion to cost of container.

5. The percentage of containers returned in defective condition is found to be so small as to be almost negligible, and there have been practically no claims made for such.

6. In the cases where claims have been made, no difficulty of note has been experienced, especially where claims are filed supported by documents in accordance with standard American Railroad Association rules.

7. We find it to be the practice that the majority of containers are returned well within the 90-day period allowed, except in the case of gas cylinders, where the average time is about 10 months.

8. Containers as utilized are constructed on specifications of the Interstate Commerce Commission or Bureau of Explosives.

9. The average life of containers has wide fluctuations, ranging from 1 to 10 years according to type of container or corrosive nature of contents.

10. The procedure of handling volatile products varies greatly. In most cases, however, extreme care is taken by the shipper and in packing before shipment. If loss is sustained, provided carelessness on part of receiver cannot be proved, credit is allowed.

11. Railroads can be held responsible for breakage only when containers received by them in good condition show signs of mishandling in transit, and in the majority of cases very little difficulty in collecting is experienced.

12. The majority of the trade follows the above-outlined practices and feeling that it is an equitable arrangement, is well satisfied with this procedure.

Trade Associations

The executive committee of the Oil Trades Association of New York met on May 13 at the Luncheon Club of the New York Produce Exchange and admitted to membership D. N. Condit & Co., Inc., and Moore & Munger. Plans for the June outing were completed.

The annual meeting of the Paint, Oil and Varnish Club of New York was held at the Hotel Biltmore last Thursday evening. Charles Cason, vice-president of the Chemical National Bank, was the principal speaker. Officers for the ensuing year were elected as follows: E. V. Peters, president; C. J. Roh, vice-president; H. G. Sidebottom, secretary; G. H. Tomlinson, treasurer. Delegates also were elected to represent the club at the annual convention of the national body.

The Purchasing Agents Association of New York will meet on June 17 to elect officers for the coming year. The nominating committee has announced the following ticket to be voted on: W. T. Hall, president; A. Fred Macklin, vice-president; R. Elberhardt, second vice-president; E. B. Fielis, treasurer.

At a meeting of the executive committee of the Chemical Salesmen's Association held at the Chemists Club, New York, on May 13, the following committee was appointed to take charge of the annual banquet which will be held in September: E. J. Barber, J. W. Boyer, E. A. McKinnon, Williams Haynes and A. J. Binder. William W. Kienzel, of the Emery Candle Co., was elected to membership in the association. The annual outing, which will be held in June, will be in charge of Messrs. Schwartz and Dunning. The spring golf tournament will be held at the Canoe Brook Country Club, Summit, N. J., on May 20. Entries are in charge of W. F. Tuttle.

Weather Controls Sulphate Harvest at Salt Lake

It is a well-known fact that sodium sulphate crystallizes readily when the water temperature is below 32 deg. A group of chemists and capitalists, having the occurrence under observation, noted specific dates and periods when the sulphate cast up on a certain beach of Great Salt Lake, Utah, could have been gathered profitably before it was redissolved by wave action. A 20-year weather record was furnished by the Weather Bureau Station of the United States Department of Agriculture at Saltair Beach Pavilion. It supplied the answer to the all-important question: How long do such conditions obtain and how frequently do they occur?

Assured of an average producing season of about 2 months each winter, a $25,000 harvesting, desiccating and refining plant was established last autumn and much additional equipment is being installed this season. The company is prepared, however, as admonished by the weather records, to remain idle in an occasional winter and to care for a 3 or 4 months crop in others.

Union Carbide Released From Trust Conspiracy Charge

Judge Morris A. Soper, who has been hearing the so-called "Carbide case" during the past 5 weeks in the United States District Court at Baltimore, abruptly ended it on May 9 by directing the jury to return a verdict for the defense.

The suit was brought by the Alexander Milburn Co. of Baltimore against the Union Carbide & Carbon Corporation of New York, six alleged affiliated companies and the Davis-Bournonville Co., New York, for $2,250,000 damages for alleged conspiracy to violate anti-trust laws. After reveiwing the testimony, the court said:

"The inevitable conclusions from a recital of the testimony is that the plaintiff failed in both branches of the conspiracy charged. The evidence not only failed to establish an agreement between the defendants for the allotment of government business to one defendant and the railroad business to the other party to the conspiracy, but the evidence affirmatively shows that each of the parties to the alleged conspiracy actively and energetically endeavored to secure business in the field forbidden to it under the terms of the alleged combination. It is difficult to resist the conclusion that the plaintiff has availed itself of the wide latitude which the character of its complaint afforded to make reckless charges which it had no sufficient evidence to sustain."

Counsel for the Milburn company announced that the case will be appealed to the United States Circuit Court of Appeals at Richmond, Va. The grounds for the appeal will be, he said, that Judge Soper excluded certain evidence which should have been admitted.

Financial

The board of directors of the Atlas Powder Co., has declared a dividend of $1 a share on the no par value common stock.

For quarter ended Feb. 29 the Freeport Texas Co. and subsidiaries report net income of $44,441, after depreciation and taxes, equivalent to 6 cents a share earned on the 729,844 outstanding shares of no par capital stock, as compared with $175,695, or 24 cents a share, in corresponding quarter of previous year.

Report of Lee Rubber & Tire Corp. and subsidiaries for the quarter ended March 31, 1924, shows net loss of $112,217 after expenses, depreciation and interest compared with net profit of $127,953 after interest and federal taxes in first quarter of 1923.

Report of Standard Oil Co. of New Jersey for year ended Dec. 31, 1923, shows surplus of $56,295,282 after expenses, depreciation, federal taxes, etc., equivalent after allowing for preferred dividends to $2.10 a share earned on $502,099,200 outstanding common stock. This compares with $46,242,436 or $1.61 a share on $498,587,125 common outstanding in 1922.

Men You Should Know About

SAMUEL T. BODINE has been re-elected president of the United Gas Improvement Co., Philadelphia, Pa.

JOHN J. CROWE has resigned the position of metallurgist in charge of the testing and research laboratory at the Philadelphia Navy Yard to accept the position of engineer in charge of the Air Reduction Co.'s apparatus research and development laboratory at Jersey City, N. J.

J. S. GRAVELY, consulting engineer of the Winchester Repeating Arms Co., has been elected chairman of the New Haven Chapter of the American Society for Steel Treating for the year 1924-1925.

H. W. LOUDEN, consulting engineer for La Carlota Sugar Co., Philippine Islands, is making a brief tour of the United States en route to England. He expects to sail from New York at an early date.

P. E. MCKINNEY, superintendent of the forge and foundry division of the U. S. Naval Gun Factory, Washington, D. C., spoke before the Washington Chapter of the American Society for Steel Treating, May 2, on "Pre-Natal Influence in the Heat-Treatment of Steels."

J. H. MORRIS and E. J. BLOCK have been elected assistant secretaries of the Inland Steel Co., Chicago, Ill.

Dr. R. B. MOORE has been appointed general manager of the Dorr Co. as of May 12, 1924.

W. W. OTIS has been transferred from the Marcus Hook, Pa., works to the Buffalo plant of the National Aniline & Chemical Co., Inc.

F. W. PICKARD, general manager of the dyestuffs department of E. I. du Pont de Nemours & Co., Wilmington, Del., and a vice-president of the company, has returned to his desk from a trip around the world. Accompanied by Mrs. Pickard, he sailed from New York last November, and has visited England, Europe, India, the Straits Settlements, Korea, China and Japan.

DAVID E. PIERCE has accepted a position as chemical engineer in the recently organized process division of the Atlantic Refining Co., Philadelphia, Pa. For the past 4 years he has been supervisor of the semi-works at the Jackson Laboratory of E. I. du Pont de Nemours & Co., Wilmington, Del.

Dr. W. R. WALDRON recently joined the research staff at the Jackson Laboratory of E. I. du Pont de Nemours & Co., Wilmington, Del. He was formerly with the Standard Oil Co. of Indiana at Whiting, Ind.

W. E. WELLS, general manager of the Homer Laughlin China Co., Newell, W. Va., and former president of the United States Potters Association, spoke before the members of the New Jersey Manufacturers Association at its annual meeting, Hotel Traymore, Atlantic City, May 3, on "The Romance of Pottery."

GERALD L. WENDT, of the Standard Oil Co. of Indiana, was recently elected chairman of the Chicago Section of the A.C.S.

H. O. WINSOR has been elected president of Henry Maurer & Son, New York, manufacturer of refractories with plant at Perth Amboy, N. J., succeeding CLIFFORD M. MAURER.

WALTER WOLLASTON has resigned from the operating staff of the du Pont Dye Works, Deepwater Point, N. J., to accept a responsible position with the Brunswick-Balke-Collender Co., Muskegon, Mich.

ROY YOUNG, who has been in the cement section of the National Bureau of Standards, has resigned to take up industrial work.

At an organization meeting for a Pennsylvania State Chapter of the American Institute of Chemists, held in Philadelphia, the following officers were elected for the ensuing year: CHARLES E. MULLIN, Philadelphia, president; JAMES W. KELLOGG, Harrisburg, vice-president; JOSEPH E. CHAPIN, secretary; and Dr. PETER MASUCCI, Glen Olden, treasurer. Mr. Chapin, secretary-elect, is chief chemist at the Philadelphia Navy Yard.

Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, Curtis Hotel, Minneapolis, Minn., June 9 to 14.

AMERICAN CERAMIC SOCIETY, summer meeting and tour, July 21 to Aug. 18.

AMERICAN ENGINEERING STANDARDS COMMITTEE, executive meeting, New York, July 12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN LEATHER CHEMISTS ASSOCIATION, Spring Lake, N. J., June 18 to 20.

AMERICAN PAPER AND PULP MILL SUPERINTENDENTS ASSOCIATION, Dayton, May 22 to 24.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Cleveland, Ohio, May 26 to 29.

AMERICAN SOCIETY FOR STEEL TREATING, Moline, Ill., May 22 to 23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, June 23 to 28.

CANADIAN INSTITUTE OF CHEMISTS, Queens University, Kingston, Ont., May 27 to 29.

MANUFACTURING CHEMISTS ASSOCIATION, annual meeting, India House, New York City, June 4.

NATIONAL ASSOCIATION OF PURCHASING AGENTS, Boston, May 19 to 24.

NATIONAL FERTILIZER ASSOCIATION, Kenilworth Inn, Asheville, N. C., June 9 to 14.

NATIONAL LIME ASSOCIATION, White Sulphur Springs, W. Va., May 20 to 23.

NEW JERSEY CLAY WORKERS ASSOCIATION AND EASTERN SECTION AMERICAN CERAMIC SOCIETY, summer meeting, Trenton, N. J., June 20.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, Boulder, Colo., June 25 to 28.

WORLD POWER CONFERENCE, London, June 30 to July 12.

At a meeting of the Pittsburgh (Pa.) Chapter of the American Society for Steel Treating at the William Penn Hotel, May 6, the following officers were elected for the ensuing year: DURAY SMITH, president; O. B. MCMILLEN, vice-president; and H. L. WALKER, secretary-treasurer.

At the recent meeting of the National Academy of Sciences fifteen prominent American scientists were elected to membership. Among these were Dr. WILLIAM CROWELL BRAY, associate professor of chemistry at the University of California, who was associate director of the Fixed Nitrogen Research Laboratory during 1919 and who has studied the problems connected with the internal energy of the atom; Dr. ARTHUR BECKET LAMB, of Harvard University, former member of the U. S. Fixed Nitrogen Commission and Chemical Warfare Service, who has made a special study of methods of removing deadly carbon monoxide from the air, and Dr. FREDERICK BELDING POWER, of the Bureau of Chemistry, U. S. Department of Agriculture, who discovered the active principle of chaulmoogra oil, which is used in the treatment of leprosy. He is a world authority on plant chemistry.

Obituary

ALBERT L. COLBY, a well-known consulting chemist, died recently at Torquay, England, as the result of an attack of influenza. He was a graduate of Columbia University, New York City, and was a member of the faculty of Lehigh University, Bethlehem, Pa., for a number of years. He entered the government service during the World War and went abroad in this interest in connection with the standardization of aircraft steels. Mr. Colby was the author of several technical books. He is survived by his wife and two children.

FRANK JACKSON CONOVER, of New York, vice-president and director of the Sinclair & Valentine Co., manufacturer of lithographic inks, died at his local residence, May 8, following an operation. He was 52 years of age.

Fertilizer Consumption in Italy

A report from assistant trade commissioner J. Allen Palmer at Rome, says that Italy consumed about 11,900,000 quintals of phosphates in 1913, consisting of 10,700,000 quintals of superphosphates and 1,200,000 of Thomas basic slag; 950,000 of nitrates, and about 250,000 of potash fertilizers. During 1918 the consumption of phosphates fell to the low figure of 4,300,000 quintals, but in 1922 rose to 9,000,000. Northern Italy predominates in the use of chemical fertilizers. The consumption of nitrates and potash fertilizers is considered to be very low and entirely out of proportion to the quantity of superphosphates used. The consumption of nitrates for 1923 was estimated as 930,000 quintals, and of potash as 110,000 quintals.

Market Conditions

Small Lot Buying of Chemicals Gains in Volume During Week

Sellers Report a Better Call for Many Selections—Price Changes Are Mainly Toward Lower Levels

THE market for chemical products has not varied much in recent weeks, but sellers say that inquiry for moderate amounts was better last week. Some items are selling more freely because of seasonal buying but interest was also noted in selections which are independent of seasonal influences. Round lot buying continues to be dull and consuming companies which are not already covered ahead are sticking to the policy of buying only for nearby needs.

Favorable reports are heard relative to buying by glass makers and a report from Pittsburgh says that demand for glass and glass products has improved with stocks of all kinds low. The plate glass market is described as broad with manufacturers unable to keep up with demand. Some branches of the leather and textile industries are still working on reduced scale.

Following the announcement in the preceding week of an advance in duty on nitrite of soda, it was reported that the Tariff Commission had made its report to the President on the investigation into barium dioxide. Petitions for an increase in duty and for a decrease in duty had been filed with the commission and it was stated unofficially that the findings of the commission were favorable for a higher duty.

Special interest was drawn to the market for nitrate of soda because of the establishment of new contract prices. Cables from Chile also stated that a decree had been issued whereby the sale of nitrate lands would be restricted to companies which are members of the nitrate association. American producers are not members of the association. Of still greater influence was a resolution adopted by the nitrate association to refuse to sell nitrate to producers or dealers who bought from companies not affiliated with the association. According to the wording of the resolution this restriction appeared to be comprehensive but the American producers stated it would not affect their business as it was meant to apply only to Chilean companies.

The weighted index number of *Chem. & Met.* was 151.37 for the week as compared with 152.55 for the preceding week. Numerous declines in quotation prices combined to bring about the lower levels and while many commodities are reported to be selling at close to production costs, the supply appears to exceed demand and buyers are holding a position of advantage. It is stated, however, that most manufacturing lines are working on small stocks of raw materials and a better movement of finished products would make an appreciable difference in the buying demand for chemicals with a correspondingly strengthening effect on values.

New Contract Prices for Nitrate of Soda — Borax and Boric Acid Lower — Arsenic Under Selling Pressure—Salt Cake in Large Supply—Formaldehyde Again Lowered—Tin Oxide Declines — Oxalic Acid Weak

Acids

Oxalic has been under selling pressure for some months. Imported grades have been in keen competition with domestic and at times home producers have quoted prices below the levels asked for foreign-made goods. In the present market imported oxalic is offered at 10c. per lb. and this figure is not named by all domestic producers. It has been estimated that consuming requirements last year were met by approximately equal purchases of foreign and domestic. Boric acid has been under selling pressure and the quoted prices have been reduced. The higher grades of phosphoric acid have maintained a firm position and prices were marked up to 14c. per lb. There has been no change in the position of mineral acids and sales are being put through at private terms.

Potashes

Carbonate of Potash—Scattered buying is reported with the market holding a steady course largely as a result of firm markets abroad. Spot holdings also are said to be rather small. Quotations are on a basis of 6@6¼c. per lb. for 96-98 per cent calcined and 5¾@6c. per lb. for 80-85 per cent. Hydrated 80-85 per cent was offered at 6@6¼c. per lb.

Caustic Potash—Recent inquiry has been more active and spot holdings have been reduced. Sales are said to have gone through at 7c. per lb. but 6¾c. per lb. was possible in some directions. Spot values are upheld by the fact that replacement costs are 6¾@7c. per lb., as the latter figures have been asked for shipments.

Permanganate of Potash—The firm position recently reported has been maintained and both foreign and domestic makes are quoted as strong. The inside price for imported is given as 14½c. per lb. and domestic is held at the same figure although odd lots might possibly be picked up a little under that level.

Prussiate of Potash—Bids for yellow prussiate of potash have been put out at 18c. per lb. but there are no sellers at that figure and it is difficult to buy at 18½c. per lb. as 18¾@19c. per lb. is generally asked. Shipments are held at the same levels as spot goods. Red prussiate is quiet at 35@38c. per lb.

Sodas

Bichromate of Soda—An easier tone has been apparent as a result of reports that concessions from the quoted prices have been given. Prominent factors, however, have made no change in asking prices and continue to quote 7½c. per lb. and upward. Buying is reported to be fairly active with moderate sized lots in good demand.

Caustic Soda—A better feeling has been noted in this market. Cables from South America are said to have indicated higher markets in the Argentine and Brazil and the f.a.s. quotation has been firmer than in preceding weeks. It is still possible to do 2.95c. f.a.s. in some quarters but other sellers quote 3@3.05c. per lb. New business for domestic account is going ahead at the established price levels with contract withdrawals reported to be holding up well.

Nitrate of Soda—This material has been featured by the announcement of new contract prices for shipments over the ensuing nitrate year. The new prices were established at primary points in Chile and are on a basis of: 19s. 6d. for July; 19s. 5d. for first half of August; 19s. 7d. for second half of August; 19s. 9d. for first half of September; 19s. 11d. for second half of September; £1 1d. for first half of October; £1 3d. for second half of October; £1 4½d. for first half of November; £1 6d. for second half of November; £1 7d. for first half of December; £1 8d. for second half of December; and £1 9d. for January-May. Further interest in this market has been added by the report that the Chilean Government will soon offer more nitrate lands for sale but has decreed that the sale will be restricted to companies which are members of the Nitrate Producers Association. Hence, American producers in Chile are excluded as purchasers and if this ruling remains in effect, the latter producers will find it impossible to expand their activities beyond the lands they already hold.

A resolution of the association also provides that sales will not be made to purchasers who deal with firms outside the association. Different views are held as to whether this ruling will apply to sales to American producers. The latter do not produce enough for American requirements and if they were unable to buy from other producers in Chile, the bulk of our requirements would have to come direct from producers in the association.

Nitrite of Soda—The increase in duty to 4½c. per lb. as reported in the preceding week has had a strengthening effect on values and sellers of imported are maintaining prices at 8⅝c. per lb. Some domestic producers have not yet decided on plans for future operations. With most large consumers covered for the present, buying is not active and when contracts are to be renewed it is expected that foreign material will still be in a competitive position.

Miscellaneous Chemicals

Arsenic—The waiting position of the market is having a depressing effect on values. Some holders of stocks are said to have been forced to liquidate and one lot changed hands during the week considerably under the general asking price. With consumers reserved sellers must wait for demand to reopen or must sacrifice values in order to effect sales. In some cases the latter is being done and this, temporarily at least, brings about a weak market. Imported grades on spot are openly offered at 9c. per lb. and the quotation ranges up to 10c. per lb. according to seller. Calcium arsenate is slow and is easy at 11c. per lb. at works.

Copper Sulphate—Some reports say there has been an improvement in demand and large domestic producers quote 4.90@5c. per lb. It is stated, however, that a prominent seller quoted prime large crystals at 5c. per lb. delivered to a point where the freight rate was ⅝c. per lb. This is equivalent to 4⅜c. per lb. f.o.b. works and leads to the belief that some producers are meeting competition of importers. Imported sulphate was offered at 4½c. per lb. f.o.b. cars New York.

Formaldehyde—A further recession in price was noted last week and carlots were offered at 9¾c. per lb. at works. Reports were current that this price had been bettered on actual business and keen competition is prominent among sellers.

Fusel Oil—Offerings of crude are not large and with some sellers out of the market prices are not free with asking prices ranging from $2.50 to $3 per gal. There is some difference of opinion regarding prices for refined. This arises from reports that offerings of refined vary in quality. There are sellers at $3.50 per gal. but stocks of butyl-free are said to be holding at $4.50 per gal.

Sal Ammoniac—Under a quiet trading movement prices for imported white sal ammoniac are barely steady at 6½c. per lb. on spot. Forward positions are quiet with prompt and nearby from abroad offered at 6¼c. per lb.

Sulphate of Ammonia—Export inquiry has been dull but a fair call for moderate amounts is reported to come from the domestic trade. Prices have not changed during the interval and offerings are available at $2.60 per 100 lb. at works.

Salt Cake—Stocks of by product cake in sellers' hands have been large and consumers have shown interest in the market only when price concessions have been granted. The openly quoted prices have been shaded in actual transactions. Sales of round lots are reported to have been made at $17 per ton with the asking prices ranging from $18 to $23 per ton.

Tin Oxide—Call for tin oxide has not been brisk and the fact that some sellers had been offering below the quoted price levels brought about a decline of 3c. per lb. in the quotation. The revised price is 52c. per lb. Tin crystals and bichloride of tin were quotably unchanged but it is intimated that reduced prices will be named for deliveries throughout June.

Alcohol

While demand for denatured alcohol has been less active, stocks appear to be in good hands and a steady undertone featured the market. Quotations were repeated on the basis of 45½c. per gal. for the No. 1 special, in drums, carload lots.

Butyl alcohol is available in a larger way and easier prices have been named by outside traders. First hands quote 25@30c. per lb.

Methanol prices underwent no further change, distributors holding out for 80c. per gal. on the pure, in tank cars. The undertone, however, remains easy as stocks are fairly large.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	151.37
Last week	152.55
May, 1923	178.00
May, 1922	159.00
May, 1921	143.00
May, 1920	279.00
May, 1919	227.00
May, 1918	267.00

Reductions were named in borax, boric acid, arsenic, formaldehyde and crude cottonseed oil. This lowered the index number 118 points.

Coal-Tar Products

Benzene Steady Despite Unsettlement in Petroleum Product—Cresylic Acid Offered Freely—Naphthalene Easy

REGULAR contract shipments absorbed the output of the larger producers of benzene and the market continues steady in all directions. The fact that petroleum products developed an easier price tendency had no apparent influence upon transactions in motor fuel benzene. Production of crudes has diminished in the past month and stocks are not burdensome. An easier undertone prevailed in U. S. P. phenol, refined naphthalene and cresylic acid, but no open price reductions came through.

According to the Department of Commerce imports of coal-tar chemicals in March were valued at $954,067, which compares with $1,442,696 for March a year ago. Imports for the 9 months ended March were valued at $15,102,968, which compares with $9,522,237 for the corresponding period a year ago.

Aniline Oil and Salt—First hands reported scattered business in aniline oil on the unchanged price of 16c. per lb., drums extra, carload basis, works. Aniline oil for red was nominal at 40c. per lb. Aniline salt was available at prices ranging from 22@23c. per lb., according to quantity and seller.

Benzene—While new business has not been active, production is not large enough to bring out any pressure on the market. Deliveries against existing contracts for motor fuel benzene are heavy, and this tends to keep stocks down and prices steady to firm. Larger producers of gasoline are supporting the market for the petroleum product and a drastic reduction in the selling schedule is not thought likely. Because of this situation traders in benzene face the future with confidence. The 90 per cent grade held at 23c. per gal., tank cars, works.

Cresylic Acid—Competition continues keen and the market is extremely unsettled. Scattered lots are available at concessions. Imports in the past month or so have diminished, but this has not improved matters, as domestic producers appear anxious for business. The 97 per cent grade was nominal at 65@70c. per gal., with the 95 per cent grade at 60@65c. per gal., immediate and nearby delivery.

Creosote—Exports of creosote and tar oil from the United Kingdom for the 3 months ended March 31 amounted to 9,153,748 gal., which compares with 8,951,678 gal. for the corresponding period a year ago. Manchester quotes creosote oil at 7¾d. per gal., loose, works, indicating that prices have eased a little.

Naphthelene—Business in refined has not come up to expectations and some selling pressure was in evidence in the past week. Most holders of white flake continue to quote around 5c. per lb., carload basis, but scattered business did go through at less. Chips, of good color, settled nominally at 4½c. per lb. Crude to import was barely steady at 2@2¼c. per lb., c.i.f. terms.

Phenol—The market was quiet, both in an export and domestic way, with the undertone easy. Leading makers quote 26c. per lb., in drums, nearby positions. Small lots of U.S.P. material sold at 28c. on spot.

Pyridine—Offerings from abroad scanty and market largely nominal. Small lots offered at $5@ $5.50 per gal., according to delivery. Demand quiet. Imports in March placed at 27,588 lb., valued at $11,631. Imports for the 3 months ended March 31 amounted to 105,051 lb., valued at $53,668.

Vegetable Oils and Fats

Cottonseed Oil Makes New Lows for Season—Linseed on Spot Steady—Crude Corn Oil Down—Tallow and Greases Easy

THE decline in the market for cottonseed oil was the feature during the week, prices for both crude and refined making new lows. Consuming demand was light. Scattered business went through in coconut, crude corn and refined rapeseed oil at lower figures. Tallow sold at a decline of ¼c. per lb. Linseed oil for immediate and nearby delivery held steady. Some holders of china wood oil were more friendly to the market. Olive oil foots on spot were irregular. Palm oils continued quiet.

Cottonseed Oil—Liquidation by weak holders of July oil sent the market into new low ground. On Thursday July refined oil in the option market sold down to 9.65c. per lb., which compares with 10.02c. per lb. a week ago. New crop oil, December option, sold at 8.80c. per lb., on the break. Crude oil actually sold as low as 7.90c. per lb., tank cars, f.o.b. mills, Southeast, with the settling price wholly nominal at 8c. per lb. Consuming demand has not been good, and, with the position of lard unfavorable, the opinion is spreading that in the event of a good crop of cotton prices will have to work much lower. A crop of 13,000,000 bales of cotton would provide for a large surplus of oil. News from the cotton belt has been favorable. Stocks of lard increased in the Chicago district, the estimated quantity on hand May 15 being 57,853,000 lb., against 46,364,026 lb. on May 1. Lard compound was nominally unchanged at 11⅞@12¼c. per lb., New York, with demand quiet in all directions. Spot prime summer yellow oil sold ex-store at 9⅞c. per lb. Deodorized oil on spot, in bbl., was offered at 11¼@11⅝c. per lb.

Corn Oil—Crude corn oil was easy, sales going through at 8¼@8⅜c. per lb., tank cars, f.o.b. point of production. The weakness was in sympathy with crude cottonseed oil.

Linseed Oil—The market was not active, but with few crushers willing to take on carload business for immediate shipment the undertone remained firm. The flaxseed situation underwent little change. Argentine offerings of seed increased a little and this brought out an easier feeling. May-June oil sold at 94c. per gal., carload lots, cooperage basis, while July-August sold at 92c. per gal., same terms. Planting is making good progress in the American Northwest and a substantial increase in the flaxseed acreage is expected. According to a private report on seeding nearly all districts will show a gain in acreage. Soil conditions are good. American crushers were not so active in the Argentine market and this resulted in freer offerings. Argentine seed sold at $1.86 per bu., May shipment, c.i.f. New York. At Duluth cash seed closed around $2.50¼ per bu., with inquiry good and offerings scanty. There was no improvement in the market for cake, the export quotation holding around $33@$34 per ton, f.a.s. New York.

Coconut Oil—A tank car of Ceylon type oil sold at 8⅜c. per lb., immediate delivery, f.o.b. New York. On the Pacific coast 7⅞c. was asked, with intimation that 7⅞c. might be done on a bid, tank car basis, nearby positions. Some producers refused to shade 8c. on remainder of year business, tank car basis. The market for Manila sundried copra was barely steady at 5c. asked, c.i.f. Pacific coast ports.

China Wood Oil—Prices named covered a wide range. In some directions the undertone was firmer as shipments from China are expected to be smaller, due to the slump in buying here. Tank car quotations heard late in the week ranged from 12½@13¼c. per lb., f.o.b. Pacific coast ports. In New York the market for oil in cooperage was nominal at 14¼@15c. per lb.

Official Import Statistics on Vegetable Oils

Imports of vegetable oils for the 9 months ended March 31 were smaller than a year ago. Official figures for the 9 months, with a comparison, follow:

	1924	1923
China wood, lb.	62,801,418	63,022,825
Coconut, lb.	117,326,343	160,317,104
Olive, edible, lb.	52,842,556	50,321,439
Olive, tech., gal.	1,827,789	3,982,309
Palm, lb.	65,129,122	73,139,090
Peanut, lb.	5,041,759	2,255,187
Rapeseed, gal.	1,306,289	1,241,029
Linseed, lb.	17,069,605	30,724,307
Soya bean, lb.	15,724,112	14,733,124
Other oils (free), lb.	4,715,222	.....

Soya Bean Oil—There were offerings of crude at 9½c. per lb., duty paid, f.o.b. Pacific coast points, June shipment.

Palm Oils — Market barely steady. Lagos oil on spot was offered at 7¼@7½c.; for shipment from Africa 7@7⅛c. per lb., Niger oil on spot available at 6⅝c. per lb., while 6.60c. was quoted on direct business with Africa.

Palm Kernel Oil—Spot oil in cooperage offered at 9@9¼c. per lb. On futures market was nominal at 8⅝c., in bbl., and 8⅝c., in casks.

Olive Oil Foots—Distressed parcels on spot sold at concessions. The market for prime green foots settled at 9¼@9⅜c. per lb., according to seller.

Rapeseed Oil—Refined oil afloat sold at 82½c. per gal. May shipment from England nominal at 80½c., with June at 79½c. per gal.

Fish Oils—The 600 bbl. of herring oil made this season in the Chesapeake district sold at 37@40c. per gal., tank car basis, Baltimore. A large part of the oil ran high in acid. Menhaden oil dull. Advices from Baltimore state that the fleet will not commence operating until June 15. A year ago the fishing began June 1. Crude menhaden offered at 47½@50c. per gal., tank cars, factory, summer delivery. Newfoundland cod oil nominal at 62c. per gal., in bbl., f.o.b. New York.

Tallow, Etc.—Sales of extra special tallow went through late in the week at 7⅛c. per lb., loose, a decline of ¼c. Yellow grease unsettled at 6½@6⅝c. per lb. Oleo stearine nominal at 10⅞@11c. per lb. Red oil offered at 8¾c. per lb.

Miscellaneous Materials

Antimony—Prices again lower on lack of buying interest. Chinese and Japanese brands closed at 8½@8¾c. per lb., a decline of ¼c. Cookson's "C" grade 12½@13c. per lb. Chinese needle, lump, nominal at 8¼c. per lb.

Blanc Fixe—First hands offered the dry material for immediate shipment from works at 3¾c. per lb., in bbl., carload lots. Market quiet, but fairly steady.

Dry Colors—Makers report a moderate amount of new business, and, with competition keen, prices in some directions were barely steady. Prussian blues offered at 40c. per lb., but business has gone through at concessions. Chrome yellow, chemically pure, offered at 17½@18c. per lb. Carbon gas black appears steady and leading interests quote 9@11c. per lb., in bags, on contracts, f.o.b. works, the price depending upon the grade.

Glycerine—Market easy on larger offerings in the West. Dynamite offered at 15¾c. per lb., carload lots, f.o.b. point of production. Chemically pure on spot unchanged at 16¾@17c. per lb., but some sellers not firm in their views. Crude soap lye, basis 80 per cent, loose, sold at 19⅜c. per lb., f.o.b. point of production in the West. Saponification, loose, nominal at 11¾c. per lb.

Naval Stores—Spirits of turpentine unsettled early in the week, but steady at close. Reports of sales at 91@92c. per gal. Rosins barely steady, lower grades available at $5.55 per bbl. Export inquiry slow.

Shellac—Offerings on spot larger and prices irregular. T.N. sold at 53@54c. per lb., with bleached, bonedry, at 64c. per lb. Imports of shellac for the 9 months ended March 31 amounted to 22,217,272 lb., valued at $11,911,225, which compares with 22,568,466 lb., valued at $14,234,340 for the corresponding period a year ago.

White Lead—The official contract price for pig lead declined to 7.25c. Production has fallen off somewhat and consumers are watching the market closely. The undertone was steady at the close. The position of the market for pigments underwent little change. Deliveries against existing contracts fairly large, but new business not up to the average. Corroders continued to quote on the basis of 10½c. per lb. for standard dry white lead, in casks, carload lots.

Zinc Oxide—Zinc prices advanced slightly, but this had no apparent influence on the market for oxide. Demand disappointing. Quotations held at 7⅞c. per lb. on American process, lead free, and at 7@7⅛c. per lb. on the leaded grades. French process, red seal, steady at 9⅜c. per lb.

Imports at the Port of New York

May 9 to May 15

ACIDS—Cresylic—25 dr., Liverpool, Order; 48 dr., Liverpool, W. E. Jordan & Bros. **Citric**—100 bbl., Messina, Order. **Formic** — 147 carboys, Hamburg, Innis, Speiden & Co.; 140 carboys, Rotterdam, R. W. Greeff & Co. **Tartaric**—250 keg, Genoa, Superfos Co.; 360 keg and 100 bbl., Rotterdam, W. Benkert & Co.; 150 csk., Rotterdam, Chemical National Bank.

ALUMINUM HYDRATE—450 bg., Rotterdam, R. W. Greeff & Co.

AMMONIUM CARBONATE — 15 csk., Liverpool, Turner & Co.; 13 pkg., Liverpool, Brown Bros. & Co.

AMMONIUM PERCHLORATE — 702 csk., Liverpool, Fidelity Intl. Trust Co.

ANTIMONY OXIDE—92 csk., Hull, E. Hill"s Son & Co.

ANTIMONY SULPHIDE—7 cs., London, L. H. Butcher Co.; 200 bbl. red, Havre, Heemsoth, Basse Co.

ARSENIC—118 bbl., Tampico, American Smelting & Refining Co.; 167 bbl., Melbourne, Irving Bank-Col. Trust Co.; 23 csk., Hamburg, C. B. Richard & Co.; 251 bbl., Rotterdam, American-British Chem. Supplies Co.; 102 bbl., Antwerp, Chemical National Bank; 174 bbl., Tampico, American Metal Corp.; 349 bbl., Tampico, American Smelting & Refining Co.

BARIUM CARBONATE—310 bg., Hamburg, Seaboard National Bank; 250 bg., Hamburg, Order; 640 bg., Newcastle, R. W. Greeff & Co.; 50 tons, Newcastle, Order.

BARIUM NITRATE—57 csk., Hamburg, E. Suter & Co.; 129 csk., Rotterdam, Hummel & Robinson.

BARYTES—300 bg., Rotterdam, E. L. Bullock & Sons; 400 bg., Rotterdam, Schall Color & Chemical Co.; 62 csk., Rotterdam, A. Klipstein & Co.; 2,500 bg., Rotterdam, R. Uhlich & Co.

CASEIN—635 bg., Buenos Aires, Order; 10 bg., Bordeaux, Order; 1,667 bg., Buenos Aires, Kalbfleisch Corp.

CHALK — 600 bg., Antwerp, Bankers Trust Co.

CHEMICALS — 132 cs., Havre, G. J. Wallen; 2 cs., Havre, E. Fougera & Co.; 71 bbl., Hamburg, Hummell & Robinson; 55 csk., Hamburg, Jungmann & Co.; 250 cs., Hamburg, J. C. Robold & Co.; 42 pkg., Hamburg, Pfaltz & Bauer; 3 cs., Hamburg, American National Bank; 110 csk., Hamburg, Draeger Shipping Co.; 30 csk., Rotterdam, Order; 90 csk., Rotterdam, Roessler & Hasslacher Chemical Co.; 102 csk., Rotterdam, Chemical National Bank; 10 csk., Bremen, Hummel & Robinson; 250 bbl., Bremen, Mechanics & Metals National Bank; 10 csk., Liverpool, Order; 20 bbl., Havre, Order.

CHROME ORE—40 bg., Madras, Order.

COAL-TAR DISTILLATE—6 dr., Liverpool, Monsanto Chemical Works; 125 dr., Liverpool, Order.

COBALT—5 cs. metallic, Liverpool, De Courcy, Browne, Inc.

COLORS—5 csk. aniline, Havre, American Exchange National Bank; 31 csk. do., Havre, Ciba Co.; 1 cs. do., Havre, Intl. Forwarding Co.; 8 csk. do., Havre, W. F. Sykes & Co.; 10 csk., Genoa, Ackerman Color Co.; 4 csk., Genoa, Irving Bank-Col. Trust Co.; 2 csk. dry, Hamburg, Am. Aniline Products, Inc.; 6 pkg. aniline, Hamburg, Franklin Import & Export Co.; 4 csk. aniline, Hamburg, Fezandie & Sperrie; 61 pkg. aniline colors, etc., Rotterdam, Kuttroff, Pickhardt & Co.; 7 csk. aniline, Rotterdam, G. A. Kuhl; 10 csk. do., Rotterdam, H. A. Metz & Co.; 4 pkg. do., Rotterdam, American Exchange National Bank; 32 pkg. do., Rotterdam, Grasselli Chemical Co.; 5 csk. earth, Rotterdam, A. Hurst & Co.; 57 csk. do., Rotterdam, C. J. Osborn & Co.; 41 csk. aniline, Havre, Sandoz Chemical Works; 2 csk. do., Havre, Carbic Color & Chem. Co.; 50 cs., Havre, J. Elwell Co.; 4 csk. aniline, Havre, Irving Bank-Col. Trust Co.; 22 csk. aniline, Antwerp, Order; 14 csk. aniline, Southampton, Am. Exchange National Bank.

COPPERAS — 335 bg. green, Liverpool, Brown & Roese.

DIVI-DIVI—568 bg., Pampatar, Eggers & Heinlein.

EPSOM SALT — 275 csk., Hamburg, Philadelphia National Bank; 500 bg., Hamburg, Brown Bros. & Co.; 500 bg., Bremen, Order.

FERROMANGANESE — 50 cs., Havre, De Courcy, Browne Co.; 100 cs., Marseilles, Order.

FLUORSPAR—334 bg., Hamburg, Order.

FULLERS EARTH—250 bg., London, C. B. Chrystal Co.

GLAUBER SALT — 40 csk., Hamburg, Order; 200 bg., Bremen, E. M. Sergeant & Co.; 500 bg., Bremen, Globe Shipping Co.

GUMS—200 bg. kauri, Auckland, Davies, Turner & Co.; 50 cs., Auckland, Baring Bros. & Co.; 50 cs. kauri, Auckland, Order; 315 bg. arabic, Port Said, Thurston & Braidich; 670 bg. yacca, Adelaide, Order; 250 bg. copal, Antwerp, W. Schall & Co.; 34 bg. do., Antwerp, Chemical National Bank; 48 bg. do., Antwerp, Order.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS for use in the leather and textile industry. Vienna, Austria. Agency.—10,157.

OXALIC ACID AND LACTIC ACID. Vienna, Austria. Agency.—10,157.

PHOSPHORUS, amorphous, and chlorate of potash in large quantities. Vienna, Austria. Purchase.—10,155.

ROSIN. Melbourne, Australia. Agency.—10,109.

ROSIN. Rio de Janeiro, Brazil. Agency.—10,156.

ROSIN. Milan, Italy. Agency.—10,154.

ROSIN, COPAL GUM AND TURPENTINE. Vienna, Austria. Agency.—10,154.

SULPHUR. Guadalajara, Mexico. Purchase and agency.—10,166.

TURPENTINE. Melbourne, Australia. Agency.—10,109.

OILS, VEGETABLE. Cape Town, South Africa. Agency.—10,146.

IRON OXIDE—228 bbl., Malaga, C. J. Osborn & Co.; 43 csk., Hull, J. L. Smith & Co.; 15 csk., Liverpool, Hanson & Van Winkle; 23 csk., Liverpool, J. A. McNulty; 23 csk., Liverpool, Reichard-Coulston, Inc.; 2 csk., Liverpool, E. M. & F. Waldo; 12 csk., Liverpool, Stanley, Doggett, Inc.; 46 csk., Marseilles, Order.

LEAD ACETATE — 40 csk., Hamburg, Roessler & Hasslacher Chemical Co.

MAGNESITE—875 bg., Rotterdam, Innis, Speiden & Co.; 480 bbl., Rotterdam, Brown Bros. & Co.; 10,800 bg. lump, Madras, Order; 250 bg., Hamburg, A. Kramer & Co.

MAGNESIUM CARBONATE — 42 cs., Newcastle, Order.

MAGNESIUM CHLORIDE — 180 dr., Hamburg, Brown Bros. & Co.; 336 bbl., Hamburg, Brown Bros. & Co.

MYROBALANS — 5,303 bg., Bombay, Order; 600 pkt., Calcutta, Order; 16,054 pkt., Calcutta, National City Bank.

MINERAL WHITE — 100 bbl., Hull, Whittaker, Clarke & Daniels; 101 bg., Hull, L. A. Salomon & Bro.

OCHER — 12 bbl., Marseilles, L. H. Butcher Co.; 262 bbl., Marseilles, Reichard-Coulston, Inc.; 117 bbl., Marseilles, J. L. Smith & Co.; 128 bbl., Marseilles, Order.

OILS—Cod—300 bbl., Hull, Order; 400 bbl., Aberdeen, Bankers Trust Co.; 80 csk., Halifax, Cook & Swan Co. **Cottonseed**—200 bbl. (returned), Nuevitas, D. S. Stern & Co. **Linseed** — 183 bbl., Hull, Order. **Olive Foots** (sulphur oil)—30 puns, Seville, Philadelphia National Bank; 1,250 bbl., Seville, Order; 200 bbl., Piraeus, National City Bank; 100 bbl., Leghorn, Irving Bank-Col. Trust Co. **Palm Kernel**—135 bbl., Hull, African & Eastern Trading Co.; 100 bbl., Hull, J. C. Francesconi & Co.; 208 bbl., Liverpool, Order. **Palm**—860 csk., Hamburg, African & Eastern Trading Co.; 161 csk., Liverpool, D. Bacon; 77 csk., Liverpool, Fourth Street National Bank. **Rapeseed**—1,375 bbl., Hull, J. C. Francesconi & Co.; 400 bbl., Hull, Vacuum Oil Co.; 100 bbl., Hull, Order. **Sesame**—83 bbl., Rotterdam, Ellis Jackson & Co.; 200 bbl., Rotterdam, Fontana Bros., Inc.; 100 bbl., Rotterdam, Aspegren & Co.; 100 bbl., Rotterdam, J. C. Francesconi & Co.; 250 bbl., Christiania, Order.

OIL SEEDS—Castor—13,660 bg., Coconada, Volkart Bros.; 14,279 bg., Coconada, Order; 2,716 bg., Bombay, Order; 12,596 bg., Bombay, Order; 6,114 bg., Coconada, Order. **Linseed**—59,066 bg. and 503,782 kilos (in bulk), Buenos Aires, Order. **Copra**—927 bg., Trinidad, Order.

PLUMBAGO — 388 bbl. and 250 bg., Colombo, Order; 128 bbl., Colombo, National City Bank.

POTASSIUM SALTS — 21 csk. caustic, Bremen, A. Klipstein & Co.; 7 cs. carbonate, Hamburg, C. Hardy, Inc.; 73 dr. and 94 bbl. caustic, Hamburg, Amermann & Patterson; 1,600 csk. chlorate, Hamburg, Seaboard National Bank; 300 csk. chlorate, Hamburg, Seaboard National Bank; 820 dr. caustic, Hamburg, A. Klipstein & Co.; 220 dr. caustic, Hamburg, A. Klipstein & Co.; 250 bbl. alum, Hamburg, Order; 30 csk. bicarbonate, Rotterdam, Meteor Products Co.; 150 csk. alum, Rotterdam, Mechanics & Metals National Bank; 500 bg. muriate, Bremen, Potash Importing Corp. of Am.

PUMICE—13,777 bg. and 49 csk., Canneto Lipari, Order.

PYRIDINE—6 dr., Liverpool, Order.

PYRITES — 4,783,280 kilos (in bulk), Huelva, Pyrites Co. of Am.

QUEBRACHO — 11,097 bg., Buenos Aires, Tannin Corp.; 2,000 bg., Buenos Aires, Equitable Trust Co.; 3,893 bg., Buenos Aires, Order.

QUICKSILVER—100 flasks, Seville, Order; 60 flasks, Vera Cruz, Poillon & Poirier; 31 flasks, Tampico, Order.

SAL AMMONIAC — 104 csk., Hamburg, E. Suter & Co.; 63 csk., Hamburg, Roessler & Hasslacher Chemical Co.; 23 csk., Hamburg, Order; 28 csk., Rotterdam, Roessler & Hasslacher Chemical Co.

SHELLAC—2,934 bg. and 140 cs., Calcutta, Order; 75 bg. garnet, Hamburg, Irving Bank-Col. Trust Co.; 23 cs., Rotterdam, C. F. Gerlach; 125 bg., London, Order; 50 bg. Calcutta, First National Bank, Boston; 100 bg. Calcutta, British Overseas Bank; 300 bg., Calcutta, Bank of London & South Am.; 400 bg. Calcutta, Brunswick, Balke, Collender Co.; 1,367 bg., Calcutta, Order; 10 cs. garnet, Hamburg, C. F. Gerlach.

SODIUM SALTS — 280 cs. cyanide, Havre, International Banking Corp.; 140 csk. hyposulphite, Hamburg, C. Hardy, Inc.; 311 dr. sulphite, Hamburg, C. S. Grant & Co.; 150 bbl., nitrite, Hamburg, E. Suter & Co.; 10 csk. hydrosulphite, Rotterdam, Kuttroff, Pickhardt & Co.; 112 cs. cyanide, Havre, International Banking Corp.; 204 bbl. silica fluoride, Copenhagen, Order; 18 keg prussiate, Liverpool, Tennant Sons & Co.; 335 cs. cyanide, Liverpool, Order; 20 cs. peroxide, Havre, C. Hardy, Inc.; 13,927 bg. nitrate, Iquique, E. I. du Pont de Nemours & Co.; 4,134 bg. do., Iquique, A. Gibbs & Co.; 20 bg. sulphate, Antofagasta, Kalbfleisch Corp.; 24 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 84 cs. cyanide, Liverpool, Order.

STARCH — 950 bg. potato, Rotterdam, Stein, Hall & Co.; 100 bg., Rotterdam, Brown Bros. & Co.; 498 bg., Rotterdam, Order.

TALC — 400 bg., Bordeaux, C. B. Chrystal & Co.; 200 bg., Bordeaux, Isolantite Co.; 400 bg., Bordeaux, Whitaker, Clark & Daniels; 1,300 bg., Bordeaux, L. A. Salomon & Bros.; 200 bg., Genoa, C. B. Chrystal & Co.

(*Continued on page* 812)

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

General Chemicals

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

Acetone, drums, wks.	lb.	$0.15 –	$0.15½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.47 –	.48
Formic, 85%	lb.	.12½–	.13
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½–	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04¾–	.05¼
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.10 –	.10½
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	10.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	14.00 –	15.00
Sulphuric, 66° drums	ton	19.00 –	20.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp. pd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.25 –	.30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.83 –	....
Ethyl, 190 p'f, U.S.P., bbl.	gal.	4.81 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½–	...
No. 1, 190 proof, special, dr.	gal.	.45½–	...
No. 1, 188 proof, bbl.	gal.	.52½–	...
No. 1, 188 proof, dr.	gal.	.48½–	...
No. 5, 188 proof, bbl.	gal.	.50½–	...
No. 5, 188 proof, dr.	gal.	.44½–	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.04
Potash, lump, bbl.	lb.	.02¾–	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½–	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12 –	.13
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.00 –	3.25
Antimony oxide, white, bbl.	lb.	.09 –	.09½
Arsenic, white, powd., bbl.	lb.	.09 –	.10
Arsenic, red, powd., kegs	lb.	.14½–	.15½
Barium carbonate, bbl.	ton	64.00 –	68.00
Barium chloride, bbl.	ton	88.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½–	.18
Barium nitrate, casks	lb.	.08 –	.08½
Blanc fixe, dry, bbl.	lb.	.03¾–	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.25 –	2.35
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.10½–	.11
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07½
Camphor, Jap. cases	lb.	.73 –	.74
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.07 –	.07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04¾
Domestic, heavy, bbl.	lb.	.03½–	.04
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04½–	....
Contract, tanks, wks.	lb.	.04½–	....
Cylinders, 100 lb., wks.	lb.	.05½–	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lbs	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.16½–	.17
Copper cyanide, drums	lb.	.45 –	.46
Coppersulphate, dom., bbl.,	100 lb.	4.70 –	4.90
Imp bbl.	100 lb.	4.50 –	4.60
Cream of tartar, bbl.	lb.	.20½–	.21½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.15 –	1.25
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., dr.	lb.	.14 –	.15
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 99%, dr.	gal.	$1.08 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.09½–	.10
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	3.50 –	4.00
Fusel oil, crude, drums	gal.	2.50 –	2.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	1.00 –	1.05
Glycerine, e.p., drums extra	lb.	.16½–	.17
Glycerine, dynamite, drums	lb.	.15½–	....
Glycerine, crude 80%, loose	lb.	.10½–	....
Hexamethylene, drums	lb.	.65 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.10½–	....
White, basic sulphate, casks	lb.	.09½–	....
White, in oil, kegs	lb.	.12½–	....
Red, dry, casks	lb.	.12 –	....
Red, in oil, kegs	lb.	.13½–	....
Lead acetate, white crys., bbl.	lb.	.14½–	....
Brown, broken, casks	lb.	.13½–	....
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.11½–	....
Lithopone, bags	lb.	.06½–	.06¾
Magnesium carb., tech., bags	lb.	.08½–	.08¾
Methanol, 95%, bbl.	gal.	.80 –	....
Methanol, 97%, bbl.	gal.	.82 –	....
Methanol, pure, tanks	gal.	.80 –	....
drums	gal.	.82 –	....
bbl.	gal.	.87 –	....
Methyl-acetone, t'ks.	gal.	.80 –	....
Nickel salt, double, bbl.	lb.	.09½–	.10¼
Nickel salts, single, bbl.	lb.	.10½–	.11
Orange mineral, csk	lb.	.14½–	.15½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	.09¾
Potassium bromide, gran., bbl.	lb.	.20 –	.32
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½–	.05¾
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½–	.08
Potassium hydroxide (caustic potash) drums	lb.	.06½–	.07
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.14½–	.14¾
Potassium prussiate, red, casks	lb.	.35 –	.38
Potassium prussiate, yellow, casks	lb.	.18½–	.19
Salammoniac, white, gran., casks, imported	lb.	.06½–	....
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	18.00 –	20.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.00 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk.	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½–	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04¾
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10
Sodium hyposulphite, bbl.	lb.	.02½–	.02¾
Sodium nitrite, casks	lb.	.08½–	.08¾
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.03¾
Sodium prussiate, yel. bbl.	lb.	.10 –	.11
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½–	.03¾
Sodium sulphite, crys., bbl.	lb.	.02½–	.03
Strontium nitrate, powd., bbl.	lb.	.10 –	.10½
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½–	....
Tin oxide, bbl.	lb.	.52 –	....
Tin crystals, bbl.	lb.	.35 –	....
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.05 –	.05½
Zinc cyanide, drums	lb.	.36½–	.37
Zinc dust, bbl	1b.	.08 –	.08½
Zinc oxide, lead free, bag	lb.	.07½–	....
5% lead sulphate, bags	lb.	.07½–	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.70 –	.75
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.22½–	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	....
f.f.c. drums	lb.	1.60 –	....
tech, drums	lb.	68	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl.	lb.	.80 –	.82
Benzidine sulphate, bbl.	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.82 –	85
Benzoate of soda, U.S.P., bbl.	lb.	.67 –	.72
Benzyl chloride, 95-97%, ref., carboys	lb.	.35 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.23 –	.28
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.65 –	.70
95-97%, drums, works	gal.	.60 –	.65
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.53 –	.55
Dimethylaniline, drums	lb.	.36 –	.38
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal	.26 –	.28
Diphenylamine, bbl.	lb.	.48 –	.50
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.05 –	.05½
Naphthalene, balls, bbl.	lb.	.06 –	.06½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.30
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.12 –	.13
Ortho-nitrophenol, bbl.	lb.	1.25 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.12 –	.13
Para-aminophenol, base, kegs	lb.	1.25 –	1.35
Para-aminophenol, HCl, kegs	lb.	1.45 –	1.60
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.40 –	1.50
Para-toluidine, bbl	lb.	.72 –	.80
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.28
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	25.00 –	30.00
Pyridine, imp., drums	gal.	5.00 –	5.25
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$2.00 –	$2.10
R-salt, bbl.	lb.	.55 –	.60
Salicylic acid, tech., bbl.	lb.	.31 –	.32
Salicylic acid, U.SP., bbl.	lb.	.35 –	....
Solvent naphtha, water-white, tanks	gal.	.25 –	....
Crude, tanks	gal.	.22 –	....
Sulphanilic acid, crude, bbl.	lb.	.16 –	.18
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	....
Toluene, drums, works	gal.	.30 –	....
Xylidine, drums	lb.	.48 –	.50
Xylene, pure, tanks	gal.	.40 –	....
Xylene, com., tanks	gal.	.28 –	....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.50 –	$5.60
Rosin E-I, bbl. 280 lb.		5.70 –	....
Rosin K-N, bbl. 280 lb.		5.90 –	6.10
Rosin W.G.-W.W., bbl. 280 lb.		7.00 –	7.60
Wood rosin, bbl. 280 lb.		5.80 –	5.90
Turpentine, spirits of, bbl.	gal.	.91 –	.92
Wood, steam dist., bbl.	gal.	.85 –	.....
Wood, dest. dist., bbl.	gal.	.67 –	.....
Pine tar pitch, bbl. 200 lb.		5.50 –	.....
Tar, kiln burned, bbl. 500 lb.		10.50 –	.....
Retort tar, bbl. 500 lb.		10.50 –	.....
Rosin oil, first run, bbl.	gal.	.41 –	.....
Rosin oil, second run, bbl.	gal.	.45 –	.....
Rosin oil, third run, bbl.	gal.	.47 –	.....
Pine oil, steam dist.	gal.	.65 –	.....
Pine tar oil, ref.	gal.	.50 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.05½
Grease, yellow, loose	lb.	.06½ –	.06½
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Lard compound, bbl.	lb.	.11½ –	.12
Neatsfootoil 20 deg. bbl.	gal.	1.28 –	.....
No. 1, bbl.	gal.	.88 –	.92
Oleo Stearine		.10½ –	.....
Oleo oil, No. 1, bbl.	lb.	.13 –	.....
Red oil, distilled, d.p. bbl.	lb.	.08½ –	.09½
Saponified, bbl.	lb.	.08½ –	.09½
Tallow, extra, loose	lb.	.07½ –	.....
Tallow oil, acidless, bbl.	gal.	.82 –	.....

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.15½ –	.....
Castor oil, No. 1, bbl.	lb.	.16 –	.....
Chinawood oil, bbl.	lb.	.14½ –	.15
Coconut oil, Ceylon, bbl.	lb.	.09½ –	.....
Ceylon, tanks, N.Y.	lb.	.08½ –	.....
Coconut oil, Cochin, bbl.	lb.	.09½ –	.10
Corn oil, crude, bbl.	lb.	.10½ –	.11½
Crude, tanks, (f.o.b. mill)	lb.	.08½ –	.08½
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08 –	.....
Summer yellow, bbl.	lb.	.10 –	.....
Winter yellow, bbl.	lb.	.11½ –	.11½
Linseed oil, raw, car lots, bbl.	gal.	.94 –	.....
Raw, tank cars (dom.)	gal.	.88 –	.....
Boiled, cars, bbl. (dom.)	gal.	.96 –	.....
Olive oil, denatured, bbl.	gal.	1.25 –	1.30
Sulphur, (foots) bbl.	lb.	.09½ –	.09½
Palm, Lagos, casks	lb.	.07½ –	.07½
Niger, casks	lb.	.06½ –	.....
Palm kernel, bbl.	lb.	.08½ –	.09½
Peanut oil, crude, tanks (mill)	lb.	.11½ –	.....
Peanut oil, refined, bbl.	lb.	.14½ –	.14½
Perilla, bbl.	lb.	.14 –	.14½
Rapeseed oil, refined, bbl.	gal.	.84 –	.86
Sesame, bbl.	lb.	.11½ –	.....
Soya bean (Manchurian), bbl.	lb.	.11½ –	.....
Tank, f.o.b. Pacific coast	lb.	.09½ –	.10
Tank, (f.o.b. N.Y.)	lb.	.10½ –	.....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.62 –	$0.65
Menhaden, light pressed, bbl.	gal.	.60 –	.....
White bleached, bbl.	gal.	.62 –	.....
Blown, bbl.	gal.	.66 –	.....
Crude, tanks (f.o.b. factory)	gal.	.47½ –	.50
Whale No. 1 crude, tanks, coast	lb.	–	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Coconut cake, bags	ton	$28.00 –	29.00
Cottonseed meal, f.o.b. mills	ton	36.00 –	38.00
Linseed cake, bags	ton	33.50 –	34.00
Linseed meal, bags	ton	40.00 –	42.00

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½ –	.04½
Cutch, Rangoon, bales	lb.	.13½ –	.14½
Dextrine, corn, bags 100 lb.		3.64 –	3.91
Dextrine gum, bags 100 lb.		3.99 –	4.09
Divi-divi, bags	ton	40.00 –	42.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.11½ –	.12½
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	..... –	.....
Sumac, ground, bags	ton	160.00 –	165.00
Sumac, domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100 lb.		3.07 –	3.33
Tapioca flour, bags	lb.	.05½ –	.06½

Extracts

Archil, cone., bbl.	lb.	$0.16½ –	$0.20
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09½ –	.10
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.09½ –	.10½
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.08 –	.09
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Osage Orange, powder, bg.	lb.	.14 –	.15
Quebracho, solid, 65% tannin, bbl.	lb.	.05 –	.05½
Sumac, dom., 51°, bbl.	lb.	.07 –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 –	$0.11
spot, cases	lb.	.12 –	.16
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.38 –	.42
Prussian, bbl.	lb.	.38 –	.42
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½ –	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P. Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.11½ –	.12
Paris, bulk	lb.	.26 –	.27
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.10 –	.16
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.40 –	1.45
Yellow, Chrome, C.P. bbls.	lb.	.17 –	.18
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl.	lb.	$0.20 –	$0.26
Beeswax, crude, Afr. bg	lb.	.25 –	.25½
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.38 –	.39
No. 2, North Country, bags	lb.	.29 –	.30
No. 3, North Country, bags	lb.	.21 –	.22
Japan, cases	lb.	.25 –	.26
Montan, crude, bags	lb.	.05½ –	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.06 –	....
Crude, scale 124-126 m.p. bags	lb.	.05½ –	....
Ref., 118-120 m.p., bags	lb.	.05½ –	....
Ref., 123-125 m.p., bags	lb.	.05½ –	....
Ref, 128-130 m.p., bags	lb.	.05½ –	....
Ref., 133-135 m.p., bags	lb.	.06 –	....
Ref., 135-137 m.p., bags	lb.	.06½ –	.07
Stearic acid, sgle pressed, bags	lb.	.11 –	.11½
Double pressed, bags	lb.	.11½ –	.11½
Triple pressed, bags	lb.	.13 –	.13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works 100 lb.		2.60 –	.....
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags 100 lb.		2.50 –	.....
Tankage, high grade, f.o.b. Chicago	unit	2.00 –	2.10
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.40 –	.....
Tennessee, 75%	ton	6.75 –	7.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	26.35 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.20 –	.....
Upriver coarse	lb.	.16½ –	.....
Upriver caucho ball	lb.	.16½ –	.17
Plantation—First latex crepe	lb.	.21 –	.....
Ribbed smoked sheets	lb.	.20 –	.....
Amber crepe No. 1	lb.	.20 –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.09 –	$0.14
East Indian, bold, bags	lb.	.16 –	.18
Manila, pale, bags	lb.	.18 –	.19
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.23 –	.23½
Singapore, No. 1, cases	lb.	.28 –	.29
Singapore, No. 2, cases	lb.	.21 –	.21½
Kauri, No. 1, cases	lb	.60 –	.65
Ordinary chips, cases	lb.	.20½ –	.21½
Manjak, Barbados, bags	lb.	.08 –	.11

Shellac

Shellac, orange fine, bags	lb.	$0.56 –	....
Orange superfine, bags	lb.	.58 –	....
A. C. garnet, bags	lb.	.52 –	$0.53
Bleached, bonedry	lb.	.64 –	.65
Bleached, fresh	lb.	.53 –	.54
T. N., bags	lb.	.54 –	.55

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec sh. ton		$300.00 –	$400.00
Asbestos, shingle, f.o.b., Quebec sh. ton		50.00 –	70.00
Asbestos, cement, f.o.b., Quebec sh. ton		20.00 –	25.00
Barytes, grd, white, f.o.b. mills, bbl. net ton		16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt. net ton		13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl. net ton		23.00 –	24.00
Barytes, crude f.o.b. mines, bulk net ton		8.00 –	8.50
Casein, bbl., tech. lb.		.11 –	.12
China clay (kaolin) crude, No. 1, f.o.b. Ga. net ton		7.00 –	8.00
Washed, f.o.b. Ga. net ton		8.50 –	9.00
Powd., f.o.b. Ga. net ton		14.00 –	20.00
Crude f.o.b. Va. net ton		6.00 –	8.00
Ground, f.o.b. Va. net ton		13.00 –	19.00
Imp., lump, bulk net ton		15.00 –	20.00
Imp., powd. net ton		45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C. long ton		7.00 –	7.50
No. 2 f.o.b. N.C. long ton		4.50 –	5.00
No. 1 soap long ton		7.00 –	.....
No. 1 Canadian, f.o.b. mill, powd. long ton		20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl. lb.		.05½ –	.06
Ceylon, chip, bbl. lb.		.04½ –	.05
High grade amorphous crude ton		15.00 –	35.00
Gum arabic, amber, sorts, bags lb.		.12 –	.12½
Gum tragacanth, sorts, bags lb.		.48 –	.53
No. 1, bags lb.		1.25 –	1.30
Kieselguhr, f.o.b. Cal. ton		40.00 –	42.00
F.o.b. N. Y. ton		50.00 –	55.00
Magnesite, calcined, f.o.b. Cal. ton		35.00 –	45.00
Pumice stone, imp., casks lb.		.03 –	.40
Dom., lump, bbl. lb.		.06 –	.08
Dom., ground, bbl. lb.		.03 –	.05
Silica, glass sand, f.o.b. Ind. ton		2.00 –	2.50
Silica, sand blast, f.o.b. Ind. ton		2.25 –	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill. ton		20.00 –	.....
Silica, glass sand, f.o.b. Ill. ton		1.75 –	3.00
Soapstone, coarse, f.o.b. Vt., bags ton		7.50 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra ton		10.50 –	.....
Talc, 200 mesh, f.o.b. Ga., bags ton		8.00 –	12.00
Talc, 325 mesh, f.o.b. New York, grade A bags ton		14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.75 –	$4.25
Corning	bbl.	2.15 –	.....
Cabell	bbl.	1.95 –	.....
Somerset	bbl.	2.05 –	2.25
Illinois	bbl.	2.07 –	.....
Indiana	bbl.	2.08 –	.....
Kansas and Okla. under 28 deg.	bbl.	1.00 –	.....
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.20 –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 –	.....
Kerosene, ref. tank wagon	gal.	.15 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.32 –	.38
Bloomless, 30@31 grav.	gal.	.21 –	.22
Paraffin, pale 885 vis.	gal.	.17½ –	.18
Spindle, 200, pale	gal.	.22 –	.....
Petrolatum, amber, bbls.	lb.	.04½ –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	38–40
Silicon carbide refract. brick, 9-in.	1,000	1180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	.....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 –	
4-6% C	lb.	.11½–	
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50 –	
Spiegeleisen, 19-21% Mn	gr. ton	38.00 –	40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr. ton	41.50 –	46.50
50%	gr. ton	75.00 –	
Ferrotungsten, 70-80%, per lb. of W	lb.	.85 –	.95
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	
C.i.f. Atlantic seaboard	ton	19.00 –	23.00
Coke, fdry., f.o.b. ovens	ton	4.75 –	5.25
Coke, furnace, f.o.b. ovens	ton	3.60 –	4.00
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50 –	
Ilmenite, 52% TiO_2 Va	lb.	.01½–	
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.44 –	.46
Manganese ore, chemica (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	
Rutile, 95% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25 –	
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	2.50
Vanadium pentoxide, 99%	lb.	2.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12½–$0.13
Aluminum, 98 to 99%	lb.	.27 – .28
Antimony, wholesale, Chinese and Japanese	lb.	.08½– .08¾
Nickel, 99%	lb.	.27 – .30
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.44½
Lead, New York, spot	ll.	.0725–
Lead, E. St. Louis, spot	lb.	.0710–
Zinc, spot, New York	lb.	.0620
Zinc, spot, E. St. Louis	lb.	.0585
Silver (commercial)	oz.	.65½
Cadmium	lb.	.60
Bismuth (500 lb. lots)	lb.	2.40-2.45
Cobalt	lb.	2.50-3.00
Magnesium, ingots, 99%	lb.	.90-.95
Platinum, refined	oz.	115.00
Iridium	oz.	275.00-300.00
Palladium	oz.	83.00
Mercury	75 lb.	77.00-78.00
Tungsten powder	lb.	.95-1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.25
Copper rods	19.75
High brass wire	17.75
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.50
Brazed bronze tubing	24.34
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	10.25 @ 10.50
Copper, heavy and wire	10.00 @ 10.12½
Copper, light and bottoms	8.00 @ 8.12½
Lead, heavy	5.75 @ 6.00
Lead, tea	3.50 @ 3.75
Brass, heavy	5.50 @ 5.75
Brass, light	4.75 @ 4.87½
No. 1 yellow brass turnings	7.00 @ 7.25
Zinc scrap	3.50 @ 3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.59	$3.59
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.59	3.59

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Hercules Powder Co., Wilmington, Del., is said to have perfected plans for the immediate erection of a new branch plant in this vicinity, consisting of a number of buildings with equipment to provide for an output of close to 700,000 lb. of explosives of all kinds per month. It is estimated to cost approximately $300,000. John J. Grimes is manager of the Birmingham branch of the company.

California

LOS ANGELES—The Beaver Glass Mfg. Co., represented by H. Clyde Harms, Merritt Bldg., attorney, has acquired property in the Vernon industrial section, consisting of an existing building and adjoining land. Improvements will immediately be made in the structure, which will be occupied at an early date for general production. Another building will be constructed in the fall, estimated to cost close to $55,000. The company was organized recently with a capital of $1,000,000.

STOCKTON—The Stockton Mineral Products Co. has purchased property at Van Buren and Lafayette Sts. as a site for a new plant for the manufacture of special mineral roofing products under a new process. It is purposed to begin operations at an early date. E. W. True and Arthur B. Foote head the company.

BERKELEY—The California Ink Co., Camelia and 3rd Sts., has awarded a general contract to the K. E. Parker Co., 519 California St., San Francisco, for the erection of a new 3-story building at its plant, estimated to cost $37,000. Victor H. Poss, 381 Bush St., San Francisco, is consulting engineer.

POMONA—The Home Oil Co. has plans for the erection of a new storage and distributing plant at Towne Ave. and Commercial St., estimated to cost $30,000, with steel tanks and other equipment. Frank Boileau and W. E. May head the company.

CROCKETT—The California & Hawaiian Sugar Refining Co., 230 California St., San Francisco, is projecting plans for a number of extensions and improvements in its local plant over a period of about 12 months, involving an investment of close to $1,350,000, including buildings and equipment. Plans are now in preparation for the remodeling and extending of Buildings No. 2 and 3, and this work will soon be started.

EMERYVILLE—The Paraffine Companies, Inc., 475 Brannan St., San Francisco, has awarded a general contract to K. E. Parker Co., 519 California St., San Francisco, for the erection of a 1-story and basement building at its local works to cost about $17,000.

SAN PABLO—The Pacific Sanitary Mfg. Co., manufacturer of sanitary ware, has acquired property adjoining its plant and is reported to have plans under advisement for early expansion.

Florida

MIAMI—The Biscayne Plate Glass Co., manufacturer of mirrors, etc., has tentative plans under way for the erection of a 1-story addition for general increase in production. A. H. Coollege is general manager.

FELLSMERE—The Standard Agricultural Chemical Corp. has work nearing completion on the initial units of its new plant on site near the city and purposes to commence operations at an early date. It represents an investment of about $200,000. The company plans for the construction of additional units later, all to be devoted to the manufacture of commercial fertilizers. John J. Watson, Jr., is president.

Illinois

CHICAGO—The Tidewater Oil Corp., 3433 South Racine Ave., has plans nearing completion for the construction of a new 2-story oil storage and distributing plant at 1441 West 37th St., to be 100x400 ft., estimated to cost $150,000, with equipment. A. Epstein, 2001 West Pershing Rd., is engineer. E. W. Emerson is general manager.

Indiana

VINCENNES — The Blackford Window Glass Co. has work nearing completion on its new local window glass-manufacturing plant, and purposes to begin operations at an early date. It will represent an investment in excess of $150,000, to be increased in the future.

Kentucky

LOUISVILLE—The Standard Cement Construction Co., Castle Hayne Rd., Wilmington, N. C., has plans for the erection of a new local plant for the manufacture of concrete pipe and culverts, to be 63x150 ft., estimated to cost close to $40,000, including equipment. A conveyor system for material handling will be installed. J. D. Walker is general manager.

Maryland

BALTIMORE—The Locke Insulator Co., Charles and Cromwell Sts., manufacturer of porcelain insulators for electrical service, has filed plans for the erection of a new 1-story addition, 80x83 ft., estimated to cost $26,000. Work will begin at once.

Massachusetts

HOLYOKE—The Crocker, McElwain Co., Cabot St., manufacturer of paper products, has superstructure work in progress on a new 2-story addition to its mill, 30x100 ft., for which a contract recently was awarded to D. O'Connell's Sons, 480 Hampden St., estimated to cost $45,000. A new filter plant will also be installed.

Michigan

SAGINAW—The Sears Paper Co. has tentative plans under advisement for the rebuilding of the portion of its plant, destroyed by fire, May 6, with loss estimated at $125,000, including equipment. The reconstruction is expected to cost a like amount.

Minnesota

DULUTH—The Minnesota Steel Co. is perfecting plans for the early remodeling of its blast furnace No. 2 for considerable increase in production, including relining and other work. Similar improvements in the No. 1 furnace are now in progress and it is expected that the unit will be ready to place in blast during July. An addition is under way to the merchant mill at the plant, to be equipped primarily for the manufacture of steel posts. It will be ready for service in about 60 days.

Missouri

KANSAS CITY—The Interstate Refining Co. is said to have preliminary plans under way for the rebuilding of the portion of its local plant recently destroyed by fire with loss estimated at close to $160,000, including equipment.

New Jersey

CAMDEN — The Camden Pottery Co., Orchard St. and Mount Vernon Ave., manufacturer of sanitary ware, has awarded a general building contract to E. R. Hall, 34 South 17th St., Philadelphia, Pa., for a 3-story addition to its plant, 40x82 ft., to cost approximately $35,000. T. M. Dobbins is president.

New York

MOUNT VERNON—The Lion Match Co., 1574 Pacific St., Brooklyn, has acquired the local works of William A. Clark on Washington St., heretofore used as a bronze and brass factory, for a consideration stated at close to $90,000. The new owner purposes to improve the plant and occupy at an early date for match manufacture.

BUFFALO—The Iroquois Gas Corp. has construction well under way on its proposed artificial gas plant on tract of about

80 acres of land on the Mineral Springs Rd., acquired for this purpose. The works will consist of three water-gas generators and auxiliary equipment; a battery of twenty vertical, continuous coal-gas retorts, compressor works, purifier house, boiler plant, with coke and coal-handling machinery and other labor-saving equipment. It will have a daily rating of 13,500,000 cu.ft., and will be supplemented by a 5,000,000 cu.ft. holder. It is expected to construct additional units at a later date to develop an ultimate capacity of 60,000,000 cu.ft. daily.

North Carolina

CANTON—The Champion Coated Paper Co., Hamilton, O., is arranging a fund of about $500,000, instead of a smaller sum previously noted, for expansion at the local plant of the Champion Fibre Co., recently acquired. The work is expected to require about 6 months for completion. Orders for a paper machine and beaters, with auxiliary apparatus, have been placed and contracts for other equipment will be let at an early date.

Ohio

JUNCTION CITY—The Great Western Sewer Pipe Co., recently formed with a capital of $100,000 to manufacture vitrified pipe, has preliminary plans under way for the erection of a new plant on local site, to be 2-story, 145x256 ft., estimated to cost $75,000. The company is headed by John D. P. Elder and J. D. McCann.

CANTON—The American Sheet & Tin Plate Co. has plans in preparation for the erection of a number of additions to its plant for large increase in output. A new roll shop will be built. A number of air furnaces and other equipment will be installed. W. A. Harris is local manager. Headquarters of the company are in the Frick Bldg., Pittsburgh, Pa.

Oklahoma

SAPULPA—The Producers Oil Co. has acquired the local refinery of the Polar Refining Co., and will take immediate possession. Plans are being arranged for extensions and improvements. Operations will be commenced at an early date.

Oregon

ASTORIA—The Standard Oil Co. is said to be perfecting plans for extensions in its local oil storage, distributing and compounding works, to cost in excess of $650,000. It is purposed to carry out the expansion within the next 6 to 8 months.

Pennsylvania

READING—The Reading Glazed Paper Co., now being organized, plans for the early operation of a local mill for the manufacture of glazed and other special papers. The initial works will cost close to $40,000. Francis H. Bohlen, Jr. and Earl G. Harrison, both of Reading, head the company.

GLASSMERE—The Ford Motor Co., Highland Park, Detroit, Mich., is having preliminary plans drawn for the erection of an addition to its local sheet glass plant, estimated to cost approximately $90,000. Albert Kahn, 1000 Marquette Bldg., Detroit, is architect.

PHILADELPHIA — The Keystone Paper Mills Co., Mill Rd., Upper Darby, has tentative plans under advisement for the rebuilding of the portion of its plant destroyed by fire, May 2, with loss approximating $200,000, including equipment.

PITTSBURGH — The Standard Sanitary Mfg. Co., Bessemer Bldg., is completing plans and will soon take bids for the erection of a 5-story and basement building, 80x250 ft., at Galveston Ave., near South St., to cost about $350,000, with equipment. Hunting & Davis, Century Bldg., Pittsburgh, are architects and engineers.

BLAIRSVILLE—The National Plate Glass Co., Detroit, Mich., is pushing work on the rebuilding of its local plant and will have the different units ready for service during the summer. The machinery will be installed at an early date. H. J. Eckenrode is president.

MCDONALD—The General Foundry & Machine Co., Peoples Bank Bldg., Pittsburgh, has completed plans and will soon begin the erection of a 1-story foundry, 60x77 ft., on local site, for the production of brass and bronze castings. A. F. Nordenskjold, company address, is engineer.

Rhode Island

PROVIDENCE—The American Enamel Co., Neville St., manufacturer of iron enamels, has tentative plans for the rebuilding of the portion of its oven department, destroyed by fire, May 3, with loss estimated at $100,000, including equipment.

Texas

RANGER—The Phillips Petroleum Co. has selected a site about 14 miles from the city, in the vicinity of Eastland, for a new gasoline-refining plant and will have plans prepared for the initial units at an early date. The cost is estimated at $150,000, including equipment.

HOUSTON—The Texas Paint Mfg. Co., 533 West 23rd St., recently organized, has leased a local building and will equip the structure for the manufacture of a line of cold water paints, varnish products and kindred specialties. Henry Rutz is president.

Washington

RENTON—The Washington Compressed Gas Co. has awarded a general contract to Hans Pederson, Alaska Bldg., Seattle, for the erection of a new local plant, on which work will be commenced at once. It is reported to cost in excess of $50,000, with equipment. John Graham, Dexter Horton Bldg., Seattle, is architect.

TACOMA—The West Coast Steel Co., Pacific Ave. and 22nd St., is said to be perfecting plans for the early rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $225,000, including equipment. The reconstruction will cost approximately a like amount.

LONGVIEW—The Pacific Straw Board & Paper Co. has selected a site on the Cowlitz River for a new mill, and plans to begin construction at an early date. It will consist of a number of units, estimated to cost $400,000, including equipment.

West Virginia

GRAFTON—The local plant of the Royal Window Glass Co. has been acquired by O. S. Campbell and associates. The new owners plan for early operations and are said to be considering tentative propositions for enlargements for increased output.

New Companies

SENTRY PRODUCTS CO., Boston, Mass.; chemicals, disinfectants and kindred specialties; $100,000. Charles Pipenbrink is president, and Carl H. Thorne, 49 Edgemere Rd., Quincy, Mass., treasurer and representative.

RELIABLE SMELTING & REFINING CO., Grand Rapids, Mich.; operate a metal reduction plant; $100,000. Incorporators: Chester C. Woolridge, Alexander Distler and Morris Zukerman, 436 Bond Ave., Grand Rapids. The last noted is representative.

UNIVERSAL MFG. CO., Jacksonville, Fla.; insecticides, chemical specialties, etc.; $25,000. J. C. Hatcher is president; and W. L. Schaus, secretary-treasurer, both of Jacksonville.

M. & E. PRODUCTS CORP., 1301 West 15th St., Chicago, Ill.; industrial alcohol and kindred products; $150,000. Incorporators: Harry Esrig, Herman P. Scher and Sydney M. Goldstein.

WALKLIN PETROLEUM CORP., Long Beach, Calif.; refined petroleum and byproducts; $1,000,000. Incorporators: John and Matthew Walklin, and Everett Hedge, Long Beach; and T. R. Stevens, Pasadena, Calif.

KWIKLEEN CO., INC., Long Branch, N. J.; floor polishes and other compounds; $100,000. Incorporators:, John H. Davis, Jr., Charles Rosencrans and Thomas J. Berkstresser, 33 2nd Ave., Long Branch. The last noted is representative.

GENERAL TISSUE CORP., Frankfort, N. Y.; tissues and other papers; $75,000. Incorporators: L. Hecht, L. May and H. A. Gilmore, Frankfort. Representative: C. D. Thomas, attorney, Herkimer, N. Y.

NATIONAL CHEMICAL CO. OF CALIFORNIA, INC., San Francisco; chemicals and chemical byproducts; $250,000. Incorporators: Louis G. Greene, F. G. Cartwright and H. L. Huston. Representative: Sloss, Ackerman & Bradley, Mills Bldg., San Francisco.

SUPERIOR PAINT & VARNISH CO., Boston, Mass.; paints, oils, varnishes, etc.; $100,000. Ferdinand Ruth, president; Jacob I. Orkin, 26 Hancock St., Boston, treasurer and representative.

MINOX CHEMICAL CORP., New York, N. Y.; chemicals and chemical byproducts; $50,000. Incorporators: J. J. Slatter, P. J. Donohoe and P. Palmer. Representative: Kelley & Connolly, 77 Pine St., New York.

PARAMOUNT RUBBER MFG. CO., Akron, O.; rubber products; $50,000. Incorporators: Arthur W. Paradis and Peter C. Mooney, both of Akron.

LONE STAR PAPER MILLS, INC., Commerce, Tex.; paper products; $40,000. Incorporators: George H. Carter, T. A. Cheeves and J. M. Irwin, all of Commerce.

FEEDWATERS, INC., New York, N. Y.; chemical compounds; $50,000. Incorporators: M. Sharp, P. Adler and R. E. Eckstein. Representative: Lowenthal, Szold & Perkins, 43 Exchange Pl., New York.

GOLDEN STATE BRASS MFG. CO., Los Angeles, Calif.; brass and bronze products; $25,000. Incorporators: G. B. Stephens, G. G. Brown and Edgar C. Pratt, Los Angeles. Representative: Janeway, Beach & Pratt, 718 Title Insurance Bldg., Los Angeles.

DIVERSITY MFG. CO., Kansas City, Mo.; chemicals and chemical byproducts; capital not stated. Incorporators: Fletcher Lewis and Beverly B. Vedder, both of Kansas City, to act as president and secretary, respectively.

REINFORCED PAPER PRODUCTS CO., Detroit, Mich.; waterproof paper products; $150,000. Incorporators: M. A. McKinney, Maxwell W. Benjamin and Ralph W. McKinney, 4417 Second Blvd., Detroit. The last noted is representative.

TILO PRODUCTS CORP., East Rutherford, N. J.; paints, oils, etc.; $250,000. Principal incorporator: J. H. F. Westervelt, Maple Ave., East Rutherford.

CONNECTICUT RUBBER CO., Fall River, Mass., care of the United States Corporation Co., 65 Cedar St., New York, representative; rubber products; $300,000. Incorporators: James J. Hoctor and John T. Mahoney, Fall River; and Maurice A. Long, Brockton, Mass.

SPECIALIZED FERTILIZER CO., Canton, O.; fertilizer products; $50,000. W. L. Armstrong, Canton, is the principal incorporator.

GLASNAMEL CO., New York, N. Y.; chemical preservatives for paint; $100,000. Incorporators: H. G. Smith, D. J. Kennedy and W. F. Murphy. Representative: J. P. Nolan, 25 Broad St., New York.

WYANDOTTE RUBBER PRODUCTS CO., Wyandotte, Mich.; rubber goods; $100,000. Incorporators: Harold W. McConnell, Wyandotte; M. E. Silverstein and John W. Sanders, 358 Penobscot Bldg., Detroit, Mich. The last noted is representative.

MILLER OIL CO., Hinton, W. Va.; refined oils; $75,000. Incorporators: E. F. Thompson, Hinton; W. O. Hundley and S. H. Honaker, both of Huntington, W. Va.

Imports at New York

(*Continued from page* 808)

TARTAR—137 bg., Valparaiso, C. Pfizer & Co.; 57 csk., Naples, Tartar Chemical Works; 307 bg., Marseilles, Royal Baking Powder Co.; 210 bg., Marseilles, C. Pfizer & Co.

TURMERIC—800 bg., Alleppey, Brown Bros. & Co.; 240 bg., Alleppey, Darragh, Small & Co.; 640 bg., Alleppey, Order; 1,867 bg. finger and 500 bg. split bulb, Cochin, Order.

VALONEA—855 bg., Smyrna, Order.

VERMILION—13 csk., London, Order.

WAXES—89 bg. carnauba, Ceara, National City Bank; 113 bg. do., Ceara, Order; 12 bg. do., Parnahyba, G. Amsinck & Co.; 167 bg. do., Parnahyba, National City Bank; 112 bg. do., Parnahyba, Lazard Freres; 112 bg. do., Parnahyba, Coal & Iron National Bank; 45 bg. do., Parnahyba, Order; 200 bg. montan, Hamburg, C. B. Richard & Co.; 210 cs. beeswax, Havre, Lazard Freres; 40 cs. do., Havre, Chemical National Bank; 266 bg. paraffine, London, Smith & Nichols; 67 bg. carnauba, Rio de Janeiro, American Trading Co.; 170 bg. beeswax, Valparaiso, Coal & Iron National Bank; 21 bg. do., Valparaiso, W. Schall & Co.; 853 bg. paraffine, London, Order; 66 pkg. beeswax, Lisbon, Order.

WOOL GREASE — 1,650 bbl., Bremen, Brown Bros. & Co.; 100 bbl., Bremen, A. Klipstein & Co.; 40 bbl., Bremen, F. L. Young & Co.; 50 cs., Antwerp, Borne, Scrymser Co.

ZIRCON — 500 bg., Tuticorin, Travane Ore & Minerals Co.